Appendix B

AVIATION

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Aviation

GENERAL AVIATION FORECAST FOR THE SCAG REGION

Introduction

This chapter provides an updated perspective on the future of general aviation airports within the SCAG region. This perspective is based on information provided by the SCAG as well as a survey sent to each individual airport for both based aircraft and operations. Through this data collection as well as interviews with airport officials, forecasts were developed as planning tools for the years 2015 and 2020.

SCAG's previous General Aviation Study was conducted in 1996. This chapter is not the in-depth general aviation study that the 1996 study was. Rather it is an update on the based aircraft and annual operations forecast. Also Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) operations were estimated for the first time, as well as depicting categories of aircraft activity by engine type.

Thus, this study's primary objective was to identify forecasts for general aviation activity for the next 20 years. These forecasts are compilations of several data collection methods in order to determine each airport's projected operations and based aircraft.

A. General Aviation Trends

In general, most airports, planners and managers in the region believe that the severe decline in general aviation has stabilized and that the next 15 to 20 years will be more positive growth for a number of airports. As was reported in the comprehensive study in 1996, corporate aviation is expected to continue to increase at a higher rate compared to other sectors within the general aviation industry. Also, the re-alignment of several military bases for civilian-use airports will continue to impact general aviation activity within the region.

FAA's Forecast
According to the FAA, the general aviation active fleet is projected to total 220,804 in 2010, an increase of almost 26,000 aircraft (1.0) percent annual growth over the 12 year period (1998 – 1010). In 2010, piston powered aircraft are expected to continue to account for the majority of the fleet (79.6 percent) and turbine-powered fixed-wing accounting for 6.9 percent. Experimental aircraft and rotorcraft account for the remaining 13.5 percent. [1]

[1] FAA Aviation Forecasts, Fiscal Years 1999 – 2010. U.S. Department of Transportation, March 1999.

The FAA also expects that the turnaround being exhibited throughout the general aviation community, combined with industry-wide promotional programs, is expected to result in moderate sustained increases in the active fleet of the one percent annually mentioned above, as well as 1.6 percent increase in hours flown and a 2.5 percent annual increase in student pilot starts.[2]

The FAA goes on to caution, however, that much of the upswing is due to unprecedented economic growth. Noting that the general aviation industry is particularly vulnerable to an economic slowdown or recession, the report indicates that no one knows what the impact of a slowdown would be on general aviation.[3]

General aviation activity at combined FAA and contract towered airports increased for the second consecutive year in the FAA's fiscal year 1998. This follows declines for the first six years of the 1990s. Most of the increase occurred in local operations which were up 5.4 percent. General aviation instrument operations at FAA and contract tower airports increased 4.3 percent in 1998, also up for the second consecutive year. In 1997, general aviation operations totaled 86.4million, more than 72 percent of the total 119.6 million operations at towered and nontowered U.S. airports.

Based on data from FAA's Terminal Area Forecast (TAF) general aviation operations at nontowered airports are up 4.0 percent since 1978. This lends some support to those who contend that much of general aviation has, because of increased commercial air carrier activity, been diverted to non-towered airports. This also supports the results of the General Aviation Activity Survey, which shows that personal flying has increased as a percentage of total general aviation activity over the last 12 years – from 27.2 percent in 1985 to 38.8 percent in 1997.[4]

AOPA's Assessment

A 1998 Aircraft and Owners and Pilots Association (AOPA) poll of certificated pilots reports that 74.5 percent of its members thought the state of aviation was the same or better than it had been. Much of the strength of the recovery and the positive outlook throughout the industry, according to AOPA, can be attributed to the passage of the General Aviation Revitalization Act in 1994, which brought product liability reform to the industry, and the continued strength of the U.S. economy.

New Aircraft Production

In addition to the success of the Cessna single-engine piston models introduced in 1997, other new products have entered production. Most notable perhaps are the Cirrus SR20 and the Lancair Columbia 300. These aircraft, which are expected to begin delivery early in 1999, represent the first certified production aircraft from these companies.

Future aircraft production schedules are being increased to meet the expected renewed demand for general aviation aircraft. The Allied Signal Business Aviation Outlook

[2] FAA Aviation Forecasts, Fiscal Years 1999 – 2010. U.S. Department of Transportation, March 1999.
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forecasts delivery of 6,500 business aircraft over the 1999 to 2009 time period. This is up by 1,200 over their previous forecast. The increased numbers result from record back orders, the strong U.S. economy, fractional ownership growth at double digit rates, and interest in new models.[5]
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B. Data Collection and Forecast Methodologies

Annual Operations

The methodology developed to produce the general aviation annual operations forecasts utilized several methods of data collection and analysis. Annual operations counts for 1993 were taken from the General Aviation Study prepared for SCAG in that year. The 1997 data was obtained through surveys or interviews with individual airport managers, airport master plans, and estimates from CalTrans' Aeronautics Acoustic Aircraft Counter Program and FAA tower counts. The historical data were forecast for the time period (1993 – 1997).

Projections of annual airport operations for 2015 and 2020 were based on estimates of growth that reflected past operations data and interviews with personnel familiar with demographic and technical issues at each airport. A simple 18-year growth factor was assigned to each airport and applied to the 1997 level of operations to solve for operations in 2015. Five eighteenths (.278) of the same simple factor was then applied to the 2015 level to solve for operations in 2020.

Restated, the specific methodology was:
$OP15_n = (1 + G_{a(18)})\ OP97_a$
$OP20_a = (1+G_{a(5)})\ OP15_a$
$G_{a(5)} = .278\ G_{a(18)}$

Where:

a	Designates a specific airport
OP15, -97 and –20 and	Are the operations logged or projected at airport "a" in those years,
$G_{a(n)}$ year	Is the single-period projected growth rate at airport "a" for the nth-period, "n" being either 18 or 5.

A number of airports experienced a significant decline in operations between 1993 and 1997 but have reported an increase in operations since then. A few airports experienced

[9] FAA Aviation Forecasts, Fiscal Years 1999 – 2010. U.S. Department of Transportation, March 1999.

significant increases in operations that are not expected to continue. Using the trend line forecast method for these airports would produce unrealistic operations forecasts for the years 2015 and 2020. In these cases, judgmental forecasting has been utilized.

Judgmental forecasts are educated guesses. They are based on intuition and subjective evaluations and are frequently a strong factor in decision-making. Judgmental methods can be used either when no information or very little historical data exist. It can also be used to adjust forecasts developed by causal models or through time-series analysis, which is the case regarding these airports.

Opinions were taken from key personnel at these airports, primarily airport managers, regarding other factors that might impact the forecast as well as their anticipated percentage of growth in operations. This information was then used to develop the 2015 and 2020 operations forecasts for these airports. Airports requiring the use of judgmental forecasts are noted in the tables. The key factors impacting the judgmental trends were also included in the text regarding individual airports.

Based Aircraft

Data for 1993 regarding based aircraft was taken from the *General Aviation Study* prepared by SCAG in 1986. Data for 1997 was obtained through surveys of the airport managers, estimates from CalTrans' Aeronautics Acoustic Aircraft Counter Program, individual airports' master plans and FAA tower counts.

To calculate the 2015 and 2020 forecasts, a simple growth formula, was again used where appropriate.

As with the operations forecasts, a number of the airports experienced a significant decline in based aircraft between 1993 and 1997 and either have showed an increase the last several years or anticipate a more positive outlook based on local factors. Using a linear method for these airports would produce unrealistic based aircraft forecasts for the years 2015 and 2020. Instead, judgmental forecasting was again utilized.

Key personnel were asked their opinions regarding based aircraft at their airport as well as what they anticipate the percentage of growth to be, based on factors and trends at their airport or in the surrounding area. These factors are incorporated into the text referring to the individual airports.

C. Annual General Aviation Operations Forecast

Between the years 1993 and 1997, the Southern California region experienced a seven percent decline in general aviation operations. The overall forecast for the year 2015 anticipates an operations count of 4,775,336. This is representative of an eight percent increase between the years 1997 and 2015 with all counties expecting an overall increase in operations through year 2015. The forecast for the year 2020 is 4,987,197 operations. Percentages are expressed as decimals, e.g. “.06” is six percent and “.15” is fifteen percent.

Forecasted Operations By County for the Region							
County	**Operations 1984**	**Operations 1993**	**Operations 1997**	**Growth 1993-1997**	***2015 FORECAST***	**Growth 1997-2015**	***2020 FORECAST***
Imperial	128,927	115,800	113,152	-.02	119,639	.06	123,951
Los Angeles	2,473,510	2,332,006	2,199,752	-.05	2,318,246	.05	2,448,674
Orange	617,124	552,854	461,654	-.16	477,182	.03	481,663
Riverside	659,285	612,084	629,137	.01	722,333	.15	764,855
San Bernardino	751,296	769,772	681,962	-.13	780,894	.15	809,451
Ventura	403,197	362,093	351,731	-.03	357,042	.015	358,603
TOTALS	**5,053,339**	**4,744,609**	**4,437,388**	**-07**	**4,775,336**	**.08**	**4,987,197**

Los Angeles County forecasts the most aircraft operations in the years 2015 as well as 2020 and anticipates a five percent increase. Imperial County forecasts the lowest amount of operations for the same years with 119,639 operations in 2015 and 123,951 in 2020. Riverside and San Bernardino Counties expect the largest increase with 15 percent increase each for the next 20 years. Ventura County expects a slight increase in operations during the next 20 years with an increase of 6,872 operations

<u>Imperial County Annual Operations</u>

General aviation operations at Imperial County airports decreased by ten percent between the years 1984 and 1993. During 1993 –1997 operations dropped another two percent to 113,152. An increase of 6,487 operations, or six percent is expected between the years 1997 and 2015 and another 4312 by the year 2020 totaling 123,951. The method of forecasting for every airports in Imperial County, except Brawley Airport, was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Calipatria Airport reflected a significant increase in general aviation operations between the years 1984 and 1993 with a growth of 289 percent. The anticipated growth of 136 percent expected for this airport between the years 1993 and 2010, based on information provided by airport officials did not occur between 1993 and 1997. There was a drop to 4800 operations in

1997. Calipatria Airport's primary activity is crop dusting with approximately 95 percent of their operations devoted to agriculture. This activity was expected to increase partly due to new chemicals being introduced, which require more crop dusting as well as a growth in infestation. A 10 percent decline is expected between 1997 and 2015 from 4800 to 4320.

Imperial County Airport reflects the most general aviation operations in the county in 1997 totaling 72,868, with a slight increase in growth forecast through the year 2020. This airport's high level of activity is credited partly to the fact that it sells fuel and also possesses more facilities than the other airports in Imperial County.

Declining operations at Calexico Airport have been a result of such things as the devaluation of the peso, low tourist traffic and needed airport improvements. Calexico Airport's declining operations between the years 1993 and 1997 is expected to level off and is expected to increase ten percent between the years 1997 and 2020, according to airport staff.

Salton Sea Airport is currently in operation, but may be sold in the near future. This airport experienced a significant decline in aircraft operations between the years 1984 and 1993 but appears to have doubled its operations to 450 in 1997. No opinions regarding forecast operations could be obtained so SCAG estimated a leveling with no change during the next 20 years.

Imperial County Annual Operations

Airport	Airport Category	Operations 1984	Operations 1993	Operations 1997	Growth 1993-1997	2015 Forecast	Growth 1997-2015	*2020* Forecast
Brawley	Remote	20,000	20,000	20,000	.00	20,000	.00	20,000
Calexico	Remote	40,000	20,000	11,384	-.43	12,522	.10	15,375
Calipatria	Remote	2,727	10,600	4,800	-.55	4,320	-.10	3,768
Holtville	Remote	600	0	3,650	1.0	3,650	.00	3,650
Imperial County	Remote	62,000	65,000	72,868	.12	78,697	.08	80,708
Salton Sea	Remote	3,600	200	450	2.3	450	.00	450
TOTALS		**128,927**	**115,800**	**113,152**	**-.02**	**119,639**	**.06**	**123,951**

Los Angeles County Annual Operations

General aviation operations between the years 1993 and 1997 for airports in Los Angeles County reflected a decline of six percent. The expected number of operations for the year 2015 is 2,318,246, with growth forecast by the year 2020 represented by 2,448,674 aircraft operations, based on SCAG information. Despite the decline in operations between the years 1993 and 1997, the general aviation operations forecast suggests operations will plateau with a five percent increase during the next twenty years. The method of forecasting for all of the airports in Los Angeles County was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Van Nuys Airport, Santa Monica Airport and Long Beach Airport are forecast to have the most annual operations in years 2015 and 2020. Agua Dulce, LAX and Catalina Airport represent the lowest general aviation operations forecast for the same years.

Compton Airport reported 130,000 operations in 1984, 42,000 in 1993, and 62,275 in 1997. This airport is expected to maintain its present level of activity, according to the Los Angeles County Aviation Department. Compton Airport's location as well as the fact that many aircraft owners move their aircraft frequently between general aviation airports in Los Angeles County played a major role in the earlier decline and flat forecast in operations in the future. According to airport personnel, the operations counts for 1984 and 1993 are estimates and not entirely accurate.

Whiteman Airport reflects a thirty percent decrease in operations between 1984 and 1993, from 149,000 to 104,000 operations, and continued to decline at 14% between 1993 and 1997 with 89,732 operations in 1997. The airport is expecting a slight increase in operations totaling 94,219 in the year 2015 and 100,240 operations in the year 2020, based on information obtained from the Los Angeles County Aviation Department. Airport officials indicate that new developments on the airport will contribute to this increase.

Agua Dulce Airport experienced a significant decline in operations between the years 1984 and 1993, from 23,000 down to 3,000, according to SCAG. This decline continued between 1993 and 1997 with annual operations of 1440 in 1997. The operations forecast for the year 2010 is 516. This airport is currently for sale and may not survive.

Burbank Airport experience a significant decline in general aviation operations between 1993 and 1997 from 106,533 to 83,910. While corporate activity is increasing at the airport, flight training and recreational flying has been declining for a number of years.

With the non-addition rule going into effect at VNY, the continued growth of corporate operations may be reduced. Although the airport experienced a nine percent increase between 1993 and 1997, a five percent increase was forecast based on the present uncertainty.

Santa Monica Airport operations were down two percent between 1993 and 1997. The Airport projects annual operations will reach 250,000 by 2015 due to corporate activity and the general economy.

At Long Beach Airport there were significant increases in general aviation between 1993 and 1997 of eight percent. Based on continued trends and increased corporate activity as well as business growth such as the recent completion center by Gulfstream at the Airport, SCAG projects a 10% increase to 2020.

Hawthorne Airport dropped by 50% in a annual operations between 1993 and 1997. Although there is uncertainty about the future of Hawthorne, SCAG forecast that the decline would not continue and projects a two percent increase during the next 20 years.

Zamperini Field (Torrance Airport) increased operations by 18 percent to 204,000 in 1997. Helicopter activity is on the rise there and SCAG estimates a five percent increase in operations to 2020.

Brackett Airport had a four percent decline between 1993 and 1997, but is significantly increased since 1984. The airport indicates it expects a slight increase over the next few years and that training operations are up.

Although El Monte airport experienced a 27% drop between 1993 and 1997, operations have increased the last year. Also airport officials indicate a new terminal and restaurant will open soon, which should stop the downward trend. Therefore a three percent growth is anticipated to 2020.

Los Angeles County Annual Operations

Airport	Airport Category	Operations 1984	Operations 1993	Operations 1997	Growth 1993-1997	2015 Forecast	Growth 1997-2015	2020 Forecast
Brackett*	Core	178,674	223,181	215,464	-.04	217,619	.01	218,224
Burbank*	Core	128,136	106,533	83,910	-.22	71,323	-.15	67,824
Compton	Core	130,000	42,000	62,275	.18	64,766	.04	68,077
El Monte*	Core	173,937	185,000	116,999	-.27	120,509	.03	125,129
Hawthorne*	Core	130,060	165,872	83,438	-.50	85,107	.02	85,613
Long Beach*	Core	403,592	414,284	450,512	.08	495,563	.10	558,896
LAX*	Core	60,033	47,027	27,302	-.42	25,937	-.05	24,280
Santa Monica*	Core	215,417	216,000	211,130	-.02	250,000	.18	260,000
Van Nuys*	Core	491,156	507,781	527,216	.09	553,577	.05	588,951
Whiteman*	Core	149,000	104,000	89,732	-.14	94,219	.05	100,240
Zamperini Field*	Core	283,294	173,052	204,000	.18	214,200	.05	227,887
Agua Dulce	Fringe	23,000	3,000	1,440	-.52	935	-.35	516
Catalina	Remote	42,000	38,000	23,000	-.39	19,090	-.17	14,942
Fox Field*	Remote	65,211	99,737	103,334	.04	105,401	.20	108,095

Los Angeles County Annual Operations								
Airport	**Airport Category**	**Operations 1984**	**Operations 1993**	**Operations 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
TOTALS		**2,473,510**	**2,332,006**	**2,199,752**	**-.06**	**2,318,246**	**.05**	**2,448,674**

* Towered Airport

Orange County Annual Operations

Orange County Airports experienced a 16% decline in operations between 1993 and 1997. This decline is expected to level off with a three percent increase during the next 20 years. Operations totaled 97,929 at Fullerton and 363,725 at John Wayne Airport 1997. Fullerton Airport experienced the most significant decline with 45% decrease while John Wayne experienced a three percent decline.

In the forecast, Orange County is projected to have a three percent increase during the next 20 years with a total number of annual operations of 477,182 in 2015 and 481,663 in the year 2020. At John Wayne Airport, the airport's master plan anticipates a leveling of based aircraft will occur from 1997 until 2020, which may contribute to the slight increase over the next 20 years in operations also.

Fullerton Municipal Airport is forecast to have 98,908 operations by the year 2015, representing a one percent growth between the years 1997 and 2015. This airport is also projecting an increase in operations through the year 2020, with a forecast of 99,183 aircraft operations in the year 2020.

The method of forecasting for each airport in Orange County was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

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Orange County Annual Operations								
Airport	**Airport Category**	**Operations 1984**	**Operations 1993**	**Operations 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
Fullerton *	Core	166,677	178,339	97,929	-.45	98,908	.01	99,183
John Wayne*	Core	405,447	374,515	363,725	-.03	378,274	.04	382,480
Meadowlark **	Core	45,000	0	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
TOTALS		**617,124**	**552,854**	**461,654**	**-.16**	**477,182**	**.03**	**481,663**

*Towered Airport
**Meadowlark Airport closed in 1989

Riverside County Annual Operations

Between the years 1993 and 1997, Riverside County experienced a one percent increase in aircraft operations. A 15 percent increase is anticipated between the years 1997 and 2020 with an operations forecast of 764,855 in the year 2020.

Desert Resorts (Thermal Airport), French Valley Airport, Hemet Ryan Airport and Palm Springs International Airport are forecast to have the most operations in general aviation operations by the year 2020. Airports forecast to have relatively few operations compared to other airports in the county are Desert Center Airport and Chiriaco Summit Airport.

Corona Airport experienced a notable decline in aircraft operations between the years 1984 and 1993 of 58 percent, from 237,000 in 1984 to 100,000 operations in 1993, according to SCAG and another forty percent decline between 1993 and 1997 to 60,000 annual operations. Corona Airport is in a maintaining mode, estimating that the decline in operations has ceased, but does not expect an increase in the near future, based on information provided by the airport. Operations counts are expected to remain constant through the year 2020 at approximately 60,000 annually. Due to environmental and other constraints, expanding Corona Airport is not feasible.

Fla-Bob Airport also encountered a decline between the years 1984 and 1993, from 48,000 operations to 27,200 respectively. This decline continued between 1993 and 1997 at a one percent rate. Growth at the airport is not anticipated. Fla-Bob Airport is currently for sale and airport officials do not anticipate any change in operations figures through the year 2020.

Hemet-Ryan Airport experienced an increase of 20,000 operations between the years 1984 and 1993. The Airport experienced an increase of 25 percent between the years 1993 and 1997 totaling 100,000. This trend is not expected to continue so the forecast to 2020 is flat. In 1998 USFS departed the Airport causing a drop in operations.

Bear Creek Airport was closed in 1997 according to airport officials.

Between the years 1993 and 1997, Bermuda Dunes aircraft operations declined from 55,000 to 45,000. This airport is anticipating a slight increase of 15 percent between 1997 and 2020 to 53,908. More hangars are currently being constructed at this airport and there is a large amount of jet activity and fuel sales, which is anticipated to keep the airport in operation.

Blythe Airport experienced a 30 percent decline in aircraft operations between the years 1993 and 1997, after a significant increase in the previous study period, from 35,000 aircraft operations to 24,650. This airport expects a one percent increase in operations by the year 2015 with a forecast of 24,897 operations and 25,146 in the year 2020.

In 1997, Chiriaco Summit Airport reported 1,800 general aviation operations, which represents a decline of 10 percent from 1993's reported 2000 operations. Chiriaco Summit Airport is expected to double its operations in the year 2015 with 2,502 estimated operations, then continue to climb to 2,773 operations through the year 2020 according to the Airport. Officials mentioned that if Desert Center Airport closes, operations would go to Chiriaco Summit.

Desert Center Airport reported a significant increase in operations of 100 percent between the years 1984 and 1993, from 1,000 to 2,000 operations. But this increase changed to a 74 percent decline in operations between 1993 and 1997. Therefore, more realistic numbers obtained by SCAG from Riverside County Aviation Department were utilized to estimate a static level of operations of 520 operations in the year 2015French Valley Airport, which opened in 1989, reported approximately 68,200 general aviation operations in 1993. In the last study, 85,000 operations were forecast for the year 2010. This information was extrapolated from French Valley's Master Plan by staff at the Riverside County Aviation Department. The Airport exceeded that with 90,000 operations in 1997, a growth of 32 percent. A three percent increase is projected through 2020 for total operations of 124,328 in 2020. Corporate aviation is increasing as well as the demand for corporate hangars.

Desert Resorts Regional Airport (formerly Thermal Airport) reported a 21 percent decline in operations between 1984 and 1993 with 35,000 and 27,600 general aviation operations respectively. Between 1993 and 1997, the airport experienced a 77 percent increase to 76,500 in 1997. Riverside County's aviation staff provided SCAG with revised numbers. Using these numbers, an operations forecast for the year 2020 of 144,051 is anticipated. Fuel sales are increasing and the runway extension on 17/35 is complete along with the ramp and FBO installation.

March Joint Use Airport is a new civil airport and in 1997 had 29,344 general aviation annual operations. The airport estimates a growth rate of 15 percent for the next 20 years to a total of 38,808 in 2020.

Palm Springs International Airport increased general aviation operations by 17 percent between 1993 and 1997, the same growth rate that was used for the 2020 forecast.

The method of forecasting for every airport in Riverside County, except Palm Springs was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Riverside County Annual Operations

Airport	Airport Category	Operations 1984	Operations 1993	Operations 1997	Growth 1993-1997	2015 Forecast	Growth 1997-2015	2020 Forecast
Corona	Fringe	237,000	100,000	60,000	-.40	60,000	.00	60,000
Fla-Bob	Fringe	48,000	27,200	27,000	-.01	27,000	.00	27,000
Riverside*	Fringe	122,410	145,081	73,343	-.49	69,676	-.05	68,708
Hemet-Ryan	Fringe	60,000	80,000	100,000	.25	100,000	.00	100,000

Riverside County Annual Operations								
Airport	**Airport Category**	**Operations 1984**	**Operations 1993**	**Operations 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
Palm Springs*	Fringe	57,005	48,983	89,480	.17	104,697	.17	109,645
Banning	Remote	12,000	14,000	10,500	-.25	10,080	-.04	9,968
Bear Creek	Remote	N/A	7,020	1,000	-.86	CLOSED	CLOSED	CLOSED
Bermuda Dunes	Remote	29,170	55,000	45,000	-.18	51750	.15	53,908
Blythe	Remote	25,000	35,000	24,650	-.30	24,897	.01	25,146
Chiriaco Summit	Remote	600	2,000	1,800	-.10	2,502	.39	2773
Desert Center	Remote	1,000	2,000	520	-.74	520	.00	520
French Valley	Remote	N/A	68,200	90,000	.32	123,300	.03	124,328
Rancho California	Remote	32,100	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
Desert Resorts Reg.	Remote	35,000	27,600	76,500	.77	123,165	.61	144,051
March Joint Use*	Remote	N/A	N/A	29,344	new	33,746	.15	38,808
TOTALS		**659,285**	**612,084**	**629,137**	**.01**	**722,333**	**.15**	**764,855**

* Towered Airport

<u>San Bernardino County Annual Operations</u>

San Bernardino County airports reflected a two percent increase in operations between 1984 and 1993 with 751,296 and 769,772 respectively. Between 1993 and 1997, the County experienced a 13 percent decline. The future for general aviation operations for this county appears relatively strong with a forecast of a 15 percent increase in growth between 1997 and 2015, totaling 780,894 operations.

General aviation operations at Cable Airport between 1993 and 1997 indicated a decline of one percent. A realistic growth suggested by SCAG between these years for the future is a one percent increase in operations. Using a one percent growth projects the 2020 forecast as 89,127.

Ontario International Airport experienced a 50 percent decline in operations between 1984 and 1993 due in part to the loss of an FBO. Operations in 1997 were 28,457, a seven percent increase, most of which will be corporate activity. Information provided by the Airport suggests that this decline will not continue and this airport will experience a slight positive growth of approximately seven percent through the year 2020. This is in keeping with the forecast from the last SCAG study.

Rialto Airport experienced a significant decrease in operations between 1993 and 1997, from 220,000 operations to 125, 000 operations. Airport officials suggested that this airport will increase in operations through the year 2020. Rialto is expected to have 128,750 operations in the year 2015 and 129,824 in the year 2020. A runway extension within the next two years will contribute to the increase in operations.

Between 1984 and 1993, Apple Valley Airport experienced a decrease in operations of 37 percent. The decline continued between 1993 and 1997 of 20 percent. Airport staff still anticipates a slight increase in operations through the year 2020 of approximately one percent and noted that a new crosswind runway currently under construction will play a major role in improving general aviation operations in the future. Skydiving and aerobatic activity also contribute to increasing operations.

Hi-Desert Airport experienced a significant loss in general aviation operations between 1984 and 1993, from 20,000 to 6,112. But between 1993 and 1997, the airport regained almost 3000 operations. A twenty percent increase in operations is projected for the next 20 years.

San Bernardino International Airport projects a significant increase between 1997 and 2020 increasing operations from 13,500 general aviation operations in 1997 to 34,313 in 2020.

Southern California Logistics Airport, as a new civil airport had 19,167 general aviation operations in 1997 (after military operations were deleted from the Airport's own forecast). The Airport projects a 47 percent increase for the next 20 years, for 31,856 annual operations.

Twenty-nine Palms Airport experienced a 125 percent increase in operations between 1993 and 1997. Information provided by the San Bernardino Aviation Department suggested that the construction of new hangars and an expected increase in flight training activity contributed to the increase. A slight increase in operations are forecast for both 2015 and 2020.

Yucca Valley Airport maintained a flat rate of growth between 1993 and 1997 and this is projected for the next 20 years.

The method of forecasting used for every airport in San Bernardino County, except for Ontario, Baker and Sun Hill Ranch Airports, was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

San Bernardino County Annual Operations								
Airport	**Airport Category**	**Operations 1984**	**Operations 1993**	**Operations 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
Cable	Fringe	140,000	88,800	88,000	-.01	88,880	.01	89,127
SanBern Int'l*	Fringe	New Civil A/P	New Civil A/P	13,500	New	33,750	.06	34,313

San Bernardino County Annual Operations								
Airport	**Airport Category**	**Operations 1984**	**Operations 1993**	**Operations 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
SoCal Logistics*	Remote	New Civil A/P	New Civil A/P	19,167	New	28,175	.47	31,856
Chino *	Fringe	198,892	200,000	194,818	-.03	243,523	.25	260,448
Ontario *	Fringe	56,626	28,260	28,457	.07	30,449	.07	31,042
Redlands	Fringe	35,000	65,000	41,600	-.36	39,936	-.04	39,491
Rialto	Fringe	120,000	220,000	125,000	-.43	128,750	.03	129,824
Apple Valley	Remote	60,000	37,600	30,000	-.20	30,300	.01	30,384
Baker	Remote	150	300	300	.00	300	.00	300
Barstow	Remote	29,040	30,000	30,000	.00	42,000	.40	46,670
Big Bear City	Remote	36,000	34,200	31,320	-.08	32,886	.05	33,343
Hesperia	Remote	3,500	17,100	17,000	-.01	17,170	.01	17,218
Hi-Desert	Remote	20,000	6,112	9,000	.47	10,800	.20	11,400
Needles	Remote	14,000	16,300	11,000	-.33	10,450	-.05	10,305
Sun Hill Ranch	Remote	188	300	300	.00	300	.00	300
29 Palms	Remote	16,000	13,300	30,000	1.25	30,600	.02	30,770
Yucca Valley	Remote	21,900	12,500	12,500	.00	12,625	.01	12,660
TOTALS		**751,296**	**769,772**	**681,962**	**-.13**	**780,894**	**.15**	**809,451**

* Towered Airport

<u>Ventura County Annual Operations</u>

Ventura County experienced a decline in general aviation operations between 1993 and 1997 of three percent to 351,731 operations in 1997. The overall operations forecast for Ventura County airports for the year 2015 is 357,042, which represents a one and a half percent increase since 1997. Operations are forecast to be 358,603 in the year 2020. This is a much more conservative forecast than was made for Ventura County by SCAG in 1993.

Camarillo Airport experienced a slight increase in operations between 1993 and 1997, from 179,025 operations to 179,398. SCAG estimates the operations forecast for the year 2015 of 182,986, which represents an increase between 1997 and 2015 of two percent. Taking into consideration Camarillo Airport's good location for general aviation activity, high income level of community surrounding the airport and an increase in experimental aircraft which has attracted many pilots to this airport, an operations forecast for the year 2020 of 184,005 is anticipated.

Oxnard Airport's operations declined by 10 percent between 1993 and 1997. SCAG anticipates a reasonable growth between the years 1997 and 2015 of one percent. This produces a forecast for the year 2015 of 121,536 operations and 121,934 in 2020.

Both Oxnard and Camarillo Airport are expecting increased operations in the future as population growth continues in this County and more pilots take advantage of the less congested airspace. An increase in corporate jet activity is likely to continue in the future as Ventura County continues to attract significant corporations.

At the same time that significant growth is expected in the County, Ventura County Department of Airports indicates that increasing community pressure to limit aircraft noise is likely to have an impact on the number of aircraft operations in the future.

Santa Paula Airport reflects a four percent increase in operations between 1993 and 1997, from 50,090 to 52,000. This increase would produce unrealistic operations forecasts for the future. Therefore the consultant and SCAG's staff suggest a one percent increase in operations between the years 1997 and 2020.

The method of forecasting used for every airport in Ventura County, was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Ventura County Annual Operations

Airport	Airport Category	Operations 1984	Operations 1993	Operations 1997	Growth 1993-1997	2015 Forecast	Growth 1997-2015	2020 Forecast
Camarillo *	Fringe	180,000	179,025	179,398	.002	182,986	.02	184,003
Oxnard *	Fringe	111,197	132,978	120,333	-.10	121,536	.01	121,934
Santa Paula	Fringe	112,000	50,090	52,000	.04	52,520	.01	52,666
TOTALS		**403,197**	**362,093**	**351,731**	**-.03**	**357,042**	**.015**	**358,603**

* Towered Airport

A. Based Aircraft Forecast

County – Regional Summary

Between the years 1984 and 1993, the Southern California region reported an overall decrease in based aircraft of 17 percent, from 13,619 to 11,287 respectively. Between the years 1993 and 1997, the decline dropped to five percent for a total general aviation operations of 10,718. The regional forecast for the year 2015 estimates a based aircraft count of 11,350. This represents a six percent increase between 1997 and 2015. The regional forecast for the year 2020 is 11,547 based aircraft.

Los Angeles County is projected to have the most based aircraft in the year 2020 with 5,127. Imperial County is expected to have the least based aircraft by the year 2020 with 252.

San Bernardino County reports the largest increase in based aircraft between 1993 and 1997. All of the counties in the region, except San Bernardino County, are anticipating an overall increase in based aircraft

Forecasted Based Aircraft By County for the Region							
County	**Based Aircraft 1984**	**Based Aircraft 1993**	**Based Aircraft 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
Imperial	243	209	207	.01	240	.33	252
Los Angeles	6,812	5017	4,563	-.11	5,027	.10	5,127
Orange	1,642	997	940	-.06	947	.01	950
Riverside	1614	1,819	1,546	-.15	1,662	.08	1740
San Bernardino	2,184	2,197	2,547	.16	2,540	-.003	2,538
Ventura	1,124	1,048	915	-.13	934	.02	940
TOTALS	**13,619**	**11,287**	**10,718**	**-.05**	**11,350**	**.06**	**11,547**

Imperial County Based Aircraft

Between the years 1984 and 1993, Imperial County airports experienced a decline in based aircraft of 14 percent, from 243 aircraft down to 209. Between 1993 and 1997 this decline continued with a 13 percent decline, with a loss of 28 aircraft. An increase in based aircraft is expected through the year 2020 with 252 based aircraft anticipated in that year.

Imperial County Airport currently possesses the most based aircraft and is anticipated to have the most in years 2010 and 2015. Salton Sea Airport and Holtville Airport have no based aircraft and are not expected to have any, although Holtville reported that if they are able to get a hangar built, aircraft owners have indicated interest in keeping their aircraft there.

Calexico Airport’s based aircraft declined 17 percent to 19 aircraft between 1993 and 1997. A growth of two percent was recommended by airport officials which gives Calexico Airport a forecast for the year 2015 of 19 based aircraft and the same in the year 2020. Improvements are expected in both operations and based aircraft at this airport. This is partly due to the construction of two factories on both sides of the border, runway improvements and plans for marketing after a new terminal is complete.

Calipatria Airport experienced an significant decline in based aircraft between years 1993 and 1997 of 48 percent. The decline of based aircraft is expected to slow through the year 2020 so SCAG estimates that a one percent decline is realistic. According to airport staff, Calipatria Airport is tied to the farming industry, with 95 percent of its based aircraft being agricultural planes. If there were no agricultural aircraft at this airport, based aircraft would probably be reduced to almost zero since fuel is not sold there and there are no facilities.

Salton Sea Airport reflected a decline of 86 percent between 1984 and 1993 and the trend continue with no based aircraft in 1997. This trend is expected to continue.

The method of forecasting used for every airports in Imperial County, except Brawley Airport, Holtville and Salton Sea Airports, was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Imperial County Based Aircraft								
County	**Airport Category**	**Based Aircraft 1984**	**Based Aircraft 1993**	**Based Aircraft 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
Brawley	Remote	74	60	65	.08	77	.08	72
Calexico	Remote	44	23	19	-.17	19	.02	19
Calipatria	Remote	19	25	13	-.48	13	-.01	13
Holtville	Remote	0	0	0	.00	0	.00	0
Imperial County	Remote	99	100	110	.10	138	.25	148
Salton Sea	Remote	7	1	0	.00	0	.00	0
TOTALS		**243**	**209**	**181**	**-.13**	**240**	**.33**	**252**

<u>Los Angeles County Based Aircraft</u>

An overall decline of 11 percent in based aircraft for airports in Los Angeles County was reported between 1993 and 1997. Predictions for based aircraft through the year 2015 suggest an increase of 10 percent, which produces a based aircraft count of 5,027 in the year 2015. A forecast of 5,127 based aircraft is expected in 2020.

Van Nuys Airport, Whiteman Airport, Long Beach Airport, Brackett Airport and Zamperini Field all forecast at least 500 based aircraft by the years 2015 and 2020. Catalina Airport and LAX are forecast with the least based aircraft in Los Angeles County with 20 aircraft or less.

Although Burbank Airport is anticipating growth in cabin class and business jet based aircraft, they are expecting a continued decline in light based aircraft of 5 percent through the year 2020. This decline suggests that Burbank Airport will have 147 based aircraft in the year 2020.

Compton Airport's based aircraft between 1984 and 1993 went from 407 to 257, a 37 percent decline. However, the airport gained nine percent based aircraft between 1993 and 1997. A three percent growth rate is estimated for the next 20 years. This estimates the based aircraft to total 290 in 2015 as well as 292 in 2020.

Hawthorne Airport experienced a decline in based aircraft between 1984 and 1993 of 23 percent and declined another 32 percent between 1993 and 1997. This decline is slowing, and SCAG forecast a decline of 20 percent during the next 20 years suggests Hawthorne Airport will have approximately 128 aircraft in the year 2015 and 121 in 2020. The future of Hawthorne Airport is somewhat uncertain at this point, which until resolved, may impact the increase in based aircraft.

Long Beach Airport experienced a two percent decline in based aircraft between 1993 and 1997. According to airport officials, a positive growth is expected between 1997 and 2020. This forecasts the based aircraft for the years 2015 and 2020 as 635 and 658 respectively. Officials credit this positive growth in the future to the support of the city of Long Beach as well as the aggressiveness of the businesses on the airport.

Santa Monica Airport experienced a decline of 39 percent in based aircraft between 1993 and 1997. According to airport officials, the decline has ceased and they are expecting a significant increase in based aircraft through the year 2020. The based aircraft count for the years 2020 are 590.

Between 1993 and 1997, Van Nuys Airport reported a 10 percent decline in based aircraft. That decline is not expected to carry into the future. Airport officials believe that the Master Plan forecast for based aircraft is too conservative and suggested a positive growth of four percent between 1997 and 2020. This forecasts a based aircraft count of 782 in the year 2015 and 791 in the year 2020.

Whiteman Airport experienced a 12 percent increase in operations between 1993 and 1997. This increase is expected to carry into the future, increase to a positive growth of 12 percent by the year 2020. Based aircraft in the year 2020 are forecast to be 648. A new terminal building and restaurant are expected to contribute to the growth at Whiteman.

Agua Dulce Airport, which reported 45 and 35 based aircraft in 1993 and 1997, is currently for sale and is not expected to survive as an airport. Therefore the forecast for based aircraft at this airport is projected to decline another 22 percent during the next 20 years.

The method of forecasting for all of the airports in Los Angeles County, except Agua Dulce and Whiteman Airport was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Los Angeles County Based Aircraft

County	Airport Category	Based Aircraft 1984	Based Aircraft 1993	Based Aircraft 1997	Growth 1993-1997	2015 Forecast	Growth 1997-2015	2020 Forecast
Brackett*	Core	500	480	505	.05	520	.03	524
Burbank*	Core	321	254	157	-.39	149	-.05	147
Compton	Core	407	257	282	.09	290	.03	292
El Monte*	Core	542	477	415	-.13	427	.03	431

Los Angeles County Based Aircraft								
County	**Airport Category**	**Based Aircraft 1984**	**Based Aircraft 1993**	**Based Aircraft 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
Hawthorne*	Core	308	237	160	-.32	128	-.20	121
Long Beach*	Core	1,092	576	562	-.02	635	.13	658
LAX*	Core	16	0	3	3.0	3	-.04	3
Santa Monica*	Core	553	500	305	-.39	560	.83	590
Van Nuys*	Core	1,245	817	752	-.10	782	.04	791
Whiteman*	Core	732	502	560	.12	627	.12	648
Zamperini Field*	Core	836	600	550	-.08	550	.00	550
Agua Dulce	Fringe	44	45	35	-.22	27	-.22	25
Catalina	Remote	20	20	12	-.40	11	-.10	11
Fox Field*	Remote	196	252	265	.05	318	.20	336
TOTALS		**6,812**	**5,017**	**4,563**	**-.11**	**5,027**	**.10**	**5,127**

* Towered Airport

Orange County Based Aircraft

Based aircraft in Orange County declined between 1984 and 1993, from 1,642 to 997. The County's based aircraft continued to decline from 1993 to 1997, by six percent with a total number of aircraft dropping to 940. The 2020 forecast anticipates a slight increase of one percent in based aircraft for the County.

In 1993, Fullerton Municipal Airport reported 450 based aircraft. By the year 1997 a 26 percent decrease had been recorded with a total of 334 based aircraft. Using this percentage of decline would produce an unrealistically low forecast for both 2015 and 2020. Therefore, a judgmental forecast was again used. The forecast for based aircraft in 2015 is 311 aircraft, which is representative of a seven percent decrease, which is the same decline rate as was projected in the last forecast. In the year 2020, 305 based aircraft are anticipated.

Between 1993 and 1997, John Wayne Airport had an increase in based aircraft of 11 percent, which represents an addition of 97 aircraft during that time. According to the County's Airport System Master Plan, the decline between 1993 and 1997 may be attributed to airspace congestion in the County, lower costs for fuel and tie downs outside the County and aircraft based outside the County for business reasons even though the business is headquartered in Orange County.

Because current trends in general aviation suggests that the decline will soon plateau and an upturn is hopeful, SCAG suggested that a five percent growth in based aircraft be used to forecast the future of based aircraft at John Wayne Airport. This growth produces a based aircraft total for the year 2015 of 636 and 645 for 2020.

As with annual operations in Orange County, it is difficult to determine a forecast of based aircraft until the future of El Toro is known.

The method of forecasting used for the airports in Orange County, was judgmental forecasting because the growth rates were determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Orange County Based Aircraft

Airport	Airport Category	Based Aircraft 1984	Based Aircraft 1993	Based Aircraft 1997	Growth 1993-1997	2015 Growth	Growth 1997-2015	2020 Forecast
Fullerton*	Core	565	450	334	-.26	311	-.07	305
John Wayne*	Core	924	547	606	.11	636	.05	645
Meadowlark	Core	153	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
TOTALS		**1,642**	**997**	**940**	**-.06**	**947**	**.01**	**950**

* Towered Airport

Riverside County Based Aircraft

An overall decline of 15 percent in based aircraft was reported for the airports in Riverside County between 1993 and 1997. This decrease followed a 13 percent increase in based aircraft during the previous study period between 1984 and 1993. The forecast for based aircraft in Riverside County indicates an increase of eight percent between 1997 and 2015 with 1,546 and 1,662 aircraft respectively. In the year 2020, based aircraft are forecast to be 1,740 at Riverside County airports.

Corona Airport is forecast to continue to have the most based aircraft, anticipating 303 aircraft in 2015 and the 295 in 2020, a decline of 10 percent from 1997. Officials at Corona Airport believe that the airport is in maintaining mode and that the decline is over, although they are not anticipating much increase. Due to environmental and other constraints, expansion is not possible, but a master plan, will look at ways of improving existing facilities.

Fla-Bob has the fourth highest number of based aircraft during the forecast period with a projected 10 percent increase to 224 based aircraft in 2020.

Riverside dropped significantly between 1993 and 1997 with a loss of 94 aircraft. SCAG projects a decline rate of 12 percent for the next 20 years so that Riverside would have approximately 154 aircraft in 2020.

Desert Center Airport and, Chiriaco Summit Airport have no based aircraft and are not expected to have any based aircraft in the future. Blythe Airport dropped 17 percent and is forecast to have 16 aircraft by 2020, a drop of 10 percent.

Fla-Bob Airport, which experienced a decline from 160 to 140 aircraft between 1984 and 1993, has been for sale for a number of years. Although based aircraft were not expected to increase or decrease by a notable amount through the year 2015 according to the last study, between 1993 and 1997 there was an increase of based aircraft of 41 percent. Therefore, the forecast for both 2015 and 2020 is a ten percent increase. This would project 224 based aircraft in 2020.

Hemet-Ryan Airport indicated a 55 percent increase in based aircraft between 1984 and 1993 but declined 25 percent from 1993 to 1997. Based on SCAG's forecast, a 10 percent increase is projected to 2020. According to officials, the United States Forest Service departed the airport in 1998, so there will not be any significant increase expected at the airport in the near future.

Between 1984 and 1993, Bermuda Dunes airport experienced an increase in growth of based aircraft of 46 percent. For the last forecast, airport officials anticipated an even larger increase in based aircraft between the years 1993 and 2010 of 51 percent. This was partly due to the construction of more hangars and a large amount of jet activity and fuel sales. But the airport increased based aircraft by 14 percent between 1993 and 1997 for a total of 116 aircraft in 1997. The forecast for this study was a more conservative 14 percent annual increase during the next 20 years, which would give the airport a total of 137 aircraft in 2020.

Blythe Airport experienced a significant decline of 47 percent in based aircraft between 1984 and 1993 and another 37 percent decline between 1993 and 1997. A 10 percent decline is anticipated for the next 20 years, which would mean 15 aircraft based at Bythe through 2020.

Chiriaco Summit Airport reported zero based aircraft in 1984 as well as 1993 and 1997. The forecast provided to SCAG suggests this may continue at this airport through 2020.
Between 1984 and 1993, Desert Center Airport lost the four aircraft that were based there. This pattern continued between 1993 and 1997 according to staff at the Riverside County Aviation Department. Therefore SCAG is estimating zero based aircraft forecast for both 2015 and 2020.

French Valley Airport reported having 155 based aircraft in 1997, a 29 percent increase. The Riverside County Aviation Department provided SCAG with a forecast of 251 based aircraft by the year 2015 which represents a 62 percent increase. The County is anticipating 50 more aircraft be based at French Valley Airport by the 2020 for a total of almost 300.

Desert Resorts Regional Airport (formerly Thermal Airport) indicated an eight percent decline in based aircraft between 1993 an 1997. This airport is expected to increase their based aircraft significantly by the year 2015 with a forecast of 120, according to the Riverside County Aviation Department. This is representative of an 88 percent increase in aircraft between 1997 and 2020.

The method of forecasting used for every airport in Riverside County, except Banning, Bermuda Dunes and Chiriaco Summit, was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Riverside County Based Aircraft

Airport	Airport Category	Based Aircraft 1984	Based Aircraft 1993	Based Aircraft 1997	Growth 1993-1997	2015 Forecast	Growth 1997-2015	2020 Forecast
Corona	Fringe	533	457	337	-.26	303	-.10	295
Fla-Bob	Fringe	160	140	198	.41	218	.10	224
Riverside *	Fringe	228	275	181	-.34	159	-.12	154
Hemet-Ryan	Fringe	217	336	253	-.25	278	.10	285
Palm Springs *	Fringe	161	178	99	-.44	94	-.05	93
Banning	Remote	62	73	75	.03	77	.03	78
Bear Creek	Remote	UNAVAILABLE	41	38	CLOSED	CLOSED	CLOSED	CLOSED
Bermuda Dunes	Remote	70	102	116	.14	132	.14	137
Blythe	Remote	51	27	17	-.37	15	-.10	15
Chicago Summit	Remote	0	0	0	.00	0	.00	0
Desert Center	Remote	4	0	0	.00	0	.00	0
French Valley	Remote	N/A	120	155	.29	251	.62	294
Rancho Calif	Remote	55	0	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
March Joint Use AFB	Remote	N/A	N/A	13	new civil a/p	15	.15	16
Desert Resorts	Remote	73	70	64	-.08	120	.88	149
TOTALS		**1,614**	**1,819**	**1546**	**-.15**	**1,662**	**.08**	**1,740**

San Bernardino County Based Aircraft

Between 1984 and 1993, a decline of only one percent was recorded for the County. The County experienced a 16 percent increase between 1993 and 1997. A very slight decline (.003 percent) is expected between 1997 and 2015 with a forecast of 2540 based aircraft, a decrease of seven aircraft. This slight decline is a result of several of the small airports in the County who will continue to decline, influencing the overall total.

Chino Airport possessed the most based aircraft in 1993 and 1997 with 800 and 940 respectively. The airport's based aircraft increased beyond forecast levels of the last report. Rapidly expanding business jet based aircraft is part of the reason for the continued increases. The Airport expects the business jet activity to double within the next five years.

Cable Airport follows Chino Airport as having the next to highest amount of based aircraft with 400 in 1993 and 359 in 1997. This represents a 10 percent decline between 1993 and 1997, but the Airport expects the next 20 years to be stable. Therefore, SCAG estimates a one percent growth for the Airport to 2020.

Baker Airport, Sun Hill Ranch Airport, Twenty-nine Palms Airport, Hi-Desert and Needles Airport are all forecast to have less than twenty-one based aircraft through the year 2020.

Rialto Airport experienced an eight percent decrease in based aircraft between 1993 and 1997. Airport officials indicate that a runway extension within two years will increase operations and based aircraft. The Airport also indicates that for the first time ever, there are no vacancies in the hangars. SCAG forecasts a slight increase at Rialto during the next 20 years which will provide a total of 225 based aircraft in 2020.

Apple Valley Airport's based aircraft increased 26 percent between the years 1984 and 1993 but declined 10 percent between 1993 and 1997 to 145. A forecast of 175 based aircraft is expected by the year 2020. This increased growth is partly due to a new crosswind runway.

Needles Airport reported an 18 percent increase in based aircraft between 1984 and 1993 but declined by 40 percent to 12 aircraft in 1997. It is anticipated that the airport may grow slightly during the next 20 years.

Yucca Valley Airport experienced a decline in based aircraft of 39 percent between 1984 and 1993 but has remained stable with 40 aircraft in 1997. The Airport's based aircraft is expected to remain level, which SCAG forecasts as zero growth for the next 20 years.

The method of forecasting used for every airport in San Bernardino County, except for Chino, Baker, Barstow and Yucca Valley Airports, was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

San Bernardino County Based Aircraft								
Airport	**Airport Category**	**Based Aircraft 1984**	**Based Aircraft 1993**	**Based Aircraft 1997**	**Growth 1993-1997**	**2015 Forecast**	**Growth 1997-2015**	**2020 Forecast**
Cable	Fringe	400	400	359	-.10	363	.01	364
San Bernardino Int'l	Fringe	New Civil A/P	New Civil A/P	30	new	75	1.5	106
So. Cal Logistics	Remote	New Civil A/P	New Civil A/P	50	new	52	.04	53
Chino*	Fringe	788	800	940	.18	1109	.18	1,164
Ontario*	Fringe	25	19	28	.47	34	.20	36
Redlands	Fringe	222	230	204	-.11	198	-.03	196
Rialto	Fringe	250	240	220	-.08	224	.02	225
Apple Valley	Remote	127	160	145	-.10	168	.16	175
Baker	Remote	1	0	0	.00	0	.00	0
Barstow	Remote	46	70	72	.03	74	.03	75
Big Bear City	Remote	145	123	119	-.03	118	-.01	118
Hesperia	Remote	56	50	43	-.14	41	-.05	40
Hi-Desert	Remote	16	24	13	-.46	10	-.26	9
Needles	Remote	17	20	12	-.40	13	.05	13
Sun Hill Ranch	Remote	5	2	1	-.50	1	.00	1
29 Palms	Remote	20	19	16	-.16	20	.25	21
Yucca Valley	Remote	66	40	40	.00	40	.00	40
TOTALS		**2,184**	**2,197**	**2547**	**.16**	**2,540**	**-.003**	**2,538**

* Towered Airport

Ventura County Based Aircraft

Between 1993 and 1997, Ventura County airports reported a thirteen percent overall decline in based aircraft. This follows a significant decline of 42 percent during the previous reporting period between 1984 and 1993. The forecast for the year 2015 is 934, a two percent growth rate. In the year 2020, a total of 940 based aircraft are anticipated in Ventura County.

Camarillo declined 18 percent between 1993 and 1997 to 510 aircraft. SCAG is projecting a two percent increase during the next 20 years which would mean the airport will have 523 based aircraft in 2020.

Oxnard Airport reported a decline in based aircraft between 1984 and 1993 of 42 percent. Based aircraft continue to decline 12 percent between 1993 and 1997. Carrying this decline into the future would produce an unrealistic forecast. Therefore, SCAG is projecting a leveling off of the decline with a slight increase during the next 20 years. Oxnard Airport is forecast to have 156 based aircraft by the year 2015 and 158 by the year 2020. The county's airport staff believes that Oxnard is in a good location to experience growth in general aviation.

The method of forecasting used for every airport in Ventura County, except Santa Paula was judgmental forecasting because the growth rate was determined based on the experience and expertise of the airport officials, SCAG staff and the consultant.

Ventura County Based Aircraft

Airport	Airport Category	**Based Aircraft 1984**	**Based Aircraft 1993**	**Based Aircraft 1997**	**Growth 1993-1997**	**2015 Forecast**	Growth 1997-2015	**2020 Forecast**
Camarillo*	Fringe	521	625	510	-.18	520	.02	523
Oxnard*	Fringe	294	170	150	-.12	156	.04	158
Santa Paula	Fringe	309	253	255	.01	258	.01	259
TOTALS		**1,124**	**1,048**	**915**	**-.13**	**934**	**.02**	**940**

* Towered Airport

B. Estimate of Annual Operations by Engine Category

For the first time, SCAG has developed an estimate of general aviation aircraft activity by category.

The following tables, by county show the estimated number of general aviation operations, by engine type. These categories are: single engine, twin engine, twin turboprop and business jets. Most airports do not keep records that specifically identify these categories. Therefore it is important to remember that the numbers provided are estimates only.

Overall, in the SCAG region the majority of operations are conducted by single engine aircraft. For the region as a whole, the estimated single engine aircraft activity accounts for 83 percent of all activity. Twin engine aircraft activity accounts for nine percent, while twin turboprops account for five percent and business jets account for the remaining three percent.

According to the *FAA's Aerospace Forecast, Fiscal Years 1999 –2010,* in 1997, the national number of hours flown by single engine piston aircraft was 66.2 percent, while multi engine aircraft accounted for 8.7 percent, with turboprops accounting for six percent and turbojets accounting for 6.1 percent. Other type aircraft, including experimentals and rotorcraft account for the remaining 13%.

The following table shows the estimated percentage of operations for airports within Imperial, Los Angeles, Orange, Riverside, San Bernardino and Ventura counties based on the four aircraft categories:

Estimated Percentage of Operations

Airport	Airport Category	Estimate % Single Eng Operations	Estimate % Twin Eng Operations	Estimate % Twin T. prop Operations	Estimate % BizJet Operations
IMPERIAL COUNTY					
Brawley	Remote	84	12	5	0
Calexico	Remote	72	16	11	1
Calipatria	Remote	84	16	0	0
Holtville	Remote	90	10	0	0
ImperialCounty	Remote	78	7	10	5
Salton Sea	Remote	99	0	1	0
TOTALS		**85**	**10**	**4**	**1**
LOS ANGELES COUNTY					
Brackett*	Core	83	12	4	1
Burbank*	Core	30	15	15	40
Compton	Core	91	7	2	0
El Monte*	Core	86	10	3	1
Hawthorne*	Core	80	5	15	1
Long Beach*	Core	67	10	3	20
LAX*	Core	5	10	20	65
Santa Monica*	Core	70	10	16	4
Van Nuys*	Core	64	17	3	16
Whiteman*	Core	80	15	4	1
Zamperini Field*	Core	87	6	7	0

Estimated Percentage of Operations					
Airport	**Airport Category**	**Estimate % Single Eng Operations**	**Estimate % Twin Eng Operations**	**Estimate % Twin T. prop Operations**	**Estimate % BizJet Operations**
Agua Dulce	Fringe	97	3	0	0
Catalina	Remote	83	7	10	0
Fox Field*	Remote	63	20	12	6
TOTALS		**70**	**11**	**8**	**11**
ORANGE COUNTY					
Fullerton*	Core	90	7	2	1
John Wayne*	Core	Not Available	Not Available	Not Available	Not Available
Meadowlark	Core	CLOSED	CLOSED	CLOSED	CLOSED
TOTALS		**90**	**7**	**2**	**1**
RIVERSIDE COUNTY					
Corona	Fringe	90	9	1	0
Fla-Bob	Fringe	95	5	0	0
Riverside *	Fringe	83	7	10	0
Hemet-Ryan	Fringe	70	15	10	5
Palm Springs *	Fringe	25	25	20	30
Banning	Remote	94	3	3	0
Bear Creek	Remote	55	45	0	0
Bermuda Dunes	Remote	40	20	20	20
Blythe	Remote	88	12	0	0
Chiriaco Summit	Remote	90	10	0	0
Desert Center	Remote	0	0	0	0
French Valley	Remote	40	38	12	10
Rancho Calif	Remote	CLOSED	CLOSED	CLOSED	CLOSED
Desert Resorts Regional	Remote	25	20	13	42
March Joint Use	Remote	99	0	1	0
TOTALS		**69**	**16**	**7**	**8**
SAN BERNARDINO COUNTY					
Cable	Fringe	91	5	4	0
San Bernardino Int'l	Fringe	80	8	8	4

Estimated Percentage of Operations					
Airport	**Airport Category**	**Estimate % Single Eng Operations**	**Estimate % Twin Eng Operations**	**Estimate % Twin T. prop Operations**	**Estimate % BizJet Operations**
So. Cal Logistics*	Remote	76	11	12	1
Chino*	Fringe	80	10	5	5
Ontario*	Fringe	15	25	25	35
Redlands	Fringe	88	6	6	.5
Rialto	Fringe	88	5	5	2
Apple Valley	Remote	70	15	10	5
Baker	Remote	90	10	0	0
Barstow	Remote	96	4	0	0
Big Bear City	Remote	90	7	2.5	.5
Hesperia	Remote	95	5	0	0
Hi-Desert	Remote	100	0	0	0
Needles	Remote	100	0	0	0
Sun Hill Ranch	Remote	100	0	0	0
29 Palms	Remote	92	8	0	0
Yucca Valley	Remote	100	0	0	0
TOTALS		**85**	**7**	**5**	**3**
VENTURA COUNTY					
Camarillo*	Fringe	90	5	4	1
Oxnard*	Fringe	89	5	5	1
Santa Paula	Fringe	97	3	0	0
TOTALS		**92**	**4**	**3**	**1**

C. <u>Estimate of VFR and IFR Activity in SCAG Region during 1997</u>

In this study, SCAG also examined the amount of general aviation activity that is using Visual Flight Rules (VFR) and how many Instrument Flight Rules (IFR) operations occurred during 1997. These are estimates only as most airports do not keep track of IFR or VFR traffic at or near their airport. The numbers are in percentages.

Region-wide, aircraft activity was primarily under visual flight rules with 92.4 percent VFR and the remaining 7.6 percent under Instrument Flight Rules (IFR). Since this is the first time reporting VFR and IFR activity, the 1997 data will be used as a baseline for future studies.

SCAG Region		
COUNTY	**Estimate % VFR Operations**	**Estimate % IFR Operations**
IMPERIAL	100	0
LOS ANGELES	88.5	11.5
ORANGE	88	12
RIVERSIDE	92	8
SAN BERNARDINO	94	6
VENTURA	93	7
TOTALS	**92.5**	**7.5**

Imperial County			
AIRPORT	**AIRPORT CATEGORY**	**Estimate % VFR Operations**	**Estimate % IFR Operations**
Brawley	Remote	100	0
Calexico	Remote	100	0
Calipatria	Remote	100	0
Holtville	Remote	100	0
Imperial County	Remote	100	0
Salton Sea	Remote	100	0
TOTALS		**100**	**0**

Los Angeles County			
AIRPORT	**AIRPORT CATEGORY**	**Estimate % VFR Operations**	**Estimate % IFR Operations**
Brackett*	Core	90	10
Burbank*	Core	50	50
Compton	Core	98	2
El Monte*	Core	97	3
Hawthorne*	Core	85	15
Long Beach*	Core	87	13
LAX*	Core	74	26
Santa Monica*	Core	80	20
Van Nuys*	Core	92	8
Whiteman*	Core	92	8
Zamperini Field*	Core	97	3
Agua Dulce	Fringe	100	0
Catalina	Remote	100	0
Fox Field*	Remote	97	3
TOTALS	Remote	88.5	11.5

* Towered Airport

Orange County			
AIRPORT	**AIRPORT CATEGORY**	**Estimate % VFR Operations**	**Estimate % IFR Operations**
Fullerton*	Core	90	10
John Wayne*	Core	85	15
Meadowlark	Core	CLOSED	CLOSED
TOTALS		**88**	**12**

Riverside County			
AIRPORT	**AIRPORT CATEGORY**	**Estimate % VFR Operations**	**Estimate % IFR Operations**
Corona	Fringe	95	5
Fla-Bob	Fringe	100	0
Riverside *	Fringe	87	13
Hemet-Ryan	Fringe	93	7
Palm Springs *	Fringe	55	45
Banning	Remote	100	0
Bear Creek	Remote	CLOSED	CLOSED
Bermuda Dunes	Remote	99	1
Blythe	Remote	100	0
Chiriaco Summit	Remote	0	0
Desert Center	Remote	0	0
French Valley	Remote	90	10
Rancho Calif	Remote	CLOSED	CLOSED
Desert Resorts Regional	Remote	98	2
March Joint Use	Remote	97	3
TOTALS	Remote	92	8

* Towered Airport

San Bernardino County			
AIRPORT	**AIRPORT CATEGORY**	**Estimate % VFR Operations**	**Estimate % IFR Operations**
Cable	Fringe	100	0
SanBern Int'l *	Fringe	92	8
SoCalLogistics*	Remote	98	2
Chino*	Fringe	85	15
Ontario*	Fringe	30	70
Redlands	Fringe	100	0
Rialto	Fringe	90	10
Apple Valley	Remote	99	1
Baker	Remote	100	0
Barstow	Remote	100	0
Big Bear City	Remote	100	0
Hesperia	Remote	100	0
Hi-Desert	Remote	100	0
Needles	Remote	100	0
Sun Hill Ranch	Remote	100	0
29 Palms	Remote	100	0
Yucca Valley	Remote	100	0
TOTALS		**94**	**6**

* Towered Airport

Ventura County			
AIRPORT	**AIRPORT CATEGORY**	**Estimate % VFR Operations**	**Estimate % IFR Operations**
Camarillo*	Fringe	91	9
Oxnard*	Fringe	88	12
Santa Paula	Fringe	100	0
TOTALS		**93**	**7**

* ToweredAirport

Dear Airport Manager:

The attached tables show the aircraft based at your airport and annual operations according SCAG's 1996 General Aviation System Study. We are in the process of developing an updated forecast to the year 2020.

Please fill in the appropriate blanks for 1997 regarding your airport on both sheets. Also provide the information on the attached survey as best as you possibly can.

Please return this survey along with the two pages of tables for the based aircraft and annual operations. (A stamped self-addressed envelope is attached or you can fax it to 805-577-0934). Thank you for your time. Please call us if you have any questions or additional comments.

Sincerely,

Christine Eberhard

encl.

Important

Southern California Association of Governments
General Aviation Forecast Update
as part of SCAG's Aviation System Plan

Please fill in the tables on the attached pages for based aircraft and annual operations during 1997. Once you have completed the tables, please answer the following questions:

1. What document did you use to obtain the based aircraft figure?____________

____

2. What document did you use to determine the annual operations?___________

____

3. Are there any special circumstances, trends or deviations that have occurred or you anticipate occurring at your airport that we should be aware of? Please explain:____

____

____

____

4. If your airport has <u>corporate</u> aircraft activity, how has it changed during the past three years and how do you anticipate it changing in the next five years?_______

____

5. Please fill in the following categories with data you have or your best estimate:
   a. Of the total number of operations in 1997, what percent were: IFR_______% VFR_______%

   b. Estimate the percentage of annual operations at your airport for the following categories:

   c. Single engine reciprocating _______%
      Twin-engine reciprocating: _______%
      Twin-engine turboprop _______%
      Business jets _______%

6. Please estimate <u>military</u> aircraft air operations during 1997 by the following categories:
   a. If you have military operations at your airport, please provide the number of annual air operations for 1997 by aircraft type:

Aircraft Type (e.g. C130, UH-60)	Number of annual operations in 1997
___________________	_________
___________________	_________
___________________	_________

   (If you have more aircraft types, please continue this list on the back side of this sheet)

   Total Number of military operations as part of your 1997 air operations: _________

   b. IFR Military Operations _______% VFR Military Operations_______%

   c. Number of Instrument Flight Rules (IFR) Practice Approaches in 1997_____

   d. Number of GCA in 1997 (Ground Controlled Approaches)_______

   e. Do you anticipate that military operations will increase during the next 20 years? Yes______ No______ Please explain____________________

   ____

   ____

   f. If you estimate an increase in military operations, please provide your best estimate for percentage growth during the next five years, (using the total number of <u>military</u> operations you provided above, as the baseline)
   ______% growth.

Thank you. Please return this survey and the two tables to: CommuniQuest
2728 Bitternut Circle
Simi Valley, CA 93065-1315

RADAM AIR CARGO MODEL—BASIC FUNCTIONS AND PARAMETERS

A Discussion Paper for the SCAG Aviation Task Force, and Air Cargo Workshops

6/08/99

Introduction

In previous regional aviation system and airport joint use studies conducted by SCAG, the Regional Airport Demand Allocation (RADAM) model was used to generate and allocate just air passenger demand. Air cargo handling potential was estimated using a much less sophisticated "top down" methodology that assessed county shares of the regional demand total based upon Los Angeles Customs District and County Business Pattern commodity and employment data. This unique methodology developed by SCAG staff was able to identify subregional cargo handling shortfalls such as in Orange County, which produces about 30% of the region's total cargo volume but handles less than 2% of that total. However, the methodology was unable to precisely allocate cargo to individual airports based on where cargo is produced and distributed in conjunction with measurements of airport attributes that are important in attracting and distributing air cargo. The new RADAM air cargo model is capable of doing this since it is a "bottoms up" model with an architecture similar to the RADAM air passenger model. As such, it is a vast improvement over previous cargo methodologies used and fully complements RADAM capabilities in air passenger simulation.

It needs to be recognized, however, that transporting cargo is very different than transporting passengers. The behavioral aspect of the model is more indirect since what is being transported does not participate in the airport decision making process. The RADAM model, based on surveys taken at employment sites and airports, reflects the decisions made by company managers (i.e., shippers) concerning which freight forwarders and/or carriers will handle their goods, and those made by freight industry managers concerning which airports they will direct their cargo to. This is a more dynamic and volatile environment than the air passenger industry since it depends less on the aggregate behavior of millions of consumers, and more on business and contractual relationships among major industry stakeholders that are constantly evolving in a highly competitive market.

Recent Trends in the Air Cargo Industry

Recent examples of the dynamism of the air cargo industry abound. After airline deregulation in 1978, the door-to-door "integrated" cargo carriers such as FedEx and UPS that operate their own all-cargo freighter aircraft quickly came to dominate the domestic air cargo market. They are increasingly making inroads in the international market as well, which is a primary reason why about 60% of the region's cargo is now transported in all-cargo aircraft, as opposed to only about 20% twenty years ago. There has also been a marked blurring between the traditional categories of freight forwarders, all-cargo carriers, passenger/cargo combination carriers, charter carriers and cargo truckers. In fact, much of what is "sold" as 2nd- or 3rd-day air cargo never sees the inside of an airplane and is transported by truck or train in a tightly-coordinated "time-definite" fashion.

The integrated air cargo operators are also increasingly providing data-intensive, value-added logistics services including supply chain management, inventory control, multimodal delivery services, cost control, and in some cases assembly and labeling. For many shippers, particularly those that extensively rely upon just-in-time (JIT) delivery of component parts and final products, moving information has become as important as moving cargo. Heavy investments in high-tech information management systems have become essential to serve these needs. The rapidly increased specialization of the air cargo industry is making it difficult for the passenger airlines, who specialize in moving passengers, to compete with the cargo carriers, even with relatively inexpensive belly capacity. The passenger carriers are wedded to airline schedules, and belly capacity increases in proportion to growth in passenger demand, which is being outstripped by demand for air cargo services.

SCAG March AFB Study

For these and other reasons, SCAG aviation staff have argued that there is potential to convert one or more of the region's recently closed or downsized military air bases into an all-cargo airport specializing in handling just air cargo. In its 1997 <u>March AFB Joint Use Feasibility Study</u>, a case study approach reviewed the success of all-cargo airports in the country. The study concluded that March has the potential to serve as an intermodal all-cargo airport and distribution center along the lines of Rickenbacker Field in Columbus, Ohio which has many similarities to March and is a successful all-cargo airport (after about 20 years of planning and development). However, it is the only public use all-cargo airport in the country that can be cited as a current success story, although there are several other all-cargo airports currently under development.

Opposing Factors

Despite emerging trends that increasingly favor the all-cargo airport concept, there is a substantial amount of inertia and a number of opposing factors to overcome. Air cargo carriers generally have a "herd mentality" and prefer to operate at large passenger hub airports where there is an extensive network of forwarders, consolidators and customs brokers to serve them. In this region, the majority of international freight forwarders and customs brokers value their proximity to LAX since they are also close to the ports and have the option of sending less time-sensitive cargo by ship if they choose. Further, many of the all-cargo freighters at LAX are operated by foreign passenger carriers such as JAL and KAL (which is an increasing trend that is spreading to U.S. carriers as well). They could be loathe to split their cargo operations from their passenger operations since they frequently shift freighter cargo to belly cargo depending on the availability of capacity. Even the integrated cargo carriers that operate for the most part independently from freight forwarders, consolidators, brokers and passenger carriers prefer having passenger belly capacity available to them for emergency situations, such as when truck deliveries fail to make it to the airport on time to load aircraft (which is becoming a worsening problem with increasing highway congestion).

Needed Incentives

The key to overcoming these factors in initiating all-cargo airport development is to provide sufficient incentives to attract initial all-cargo service to a new airport. These incentives would be devoted to upgrading airports so that they could specialize in handling cargo quickly and efficiently, and specifically meet the needs of JIT manufacturers and distributors. They could include low landing fees and lease rates, on-airport warehousing, superior ground and airfield access, fiber optics and other high-tech information infrastructure, automated customs processing, and nearby intermodal facilities including truck and rail cargo transfer centers. The financing of such incentives could be problematic for new airports without a substantial current funding stream; Rickenbacker Field, for example, did not become successful until after $80 million of public funding (local, state and federal) in critical infrastructure improvements was made (the facility has since attracted $287 million in private investment). The facility also enjoys inventory and real estate tax abatements, and other subsidies of about $3 million per year from local government. Whether substantial public funding support would be available to new all-cargo airports in this region as "seed money" to help them attract initial service is an open question.

Future Studies and RADAM Analysis

As part of this year's aviation system study, SCAG aviation staff intends to further document trends that could favor all-cargo airports including very recent activity in shifting cargo to dedicated freighters and splitting the administration and operation of all-cargo aircraft from passenger operations. An update of the status of all-cargo airports in the country, including Rickenbacker Field as well as Alliance Airport in Texas and GlobalTranspark in North Carolina will also be made. It is important to establish the viability of the all-cargo concept in this region before substantial public funding commitments are made to all-cargo airports. The recently-developed (1997) RADAM air cargo model will also be used to identify which all-cargo airports being proposed are capable of attracting the most demand for cargo handling services, in competition with combined passenger/cargo airports.

RADAM Air Cargo Model

General Structure

The RADAM version 4.2 multinomial logit (MNL) air cargo forecasting and allocation model is structurally very similar to the RADAM passenger model. Air cargo by category (i.e., express, general freight, and mail) is generated for each RADAM zone in the region based on the relative strength of socio-economic attributes (current and forecast) and historic air cargo growth trends. Travel distance to cargo-handling airports is also considered in the cargo generation phase. The second phase of the air cargo modeling process involves an allocation process in which air cargo generated for each zone is allocated to each of the competing airports in the system (existing and proposed) based on aircraft fleets, capacities, service portfolios, and ground access times to airports. Asymmetric logic is used to incorporate such factors as contractual relationships between major shipper and carriers, and between carriers and airports. The allocations to airports are refined through an iteration process which continues until an equilibrium point is attained in which all airports achieve an optimal allocation of air cargo for each cargo category, including a balance between on-loaded and off-loaded cargo. The allocation of cargo for future conditions assumes that the air cargo industry is logistically and technologically capable of operating in the most efficient manner at each of the airports.

Cargo Generation Module

The RADAM air cargo generation module uses the following primary input parameters to generate current and forecast air cargo for each category by RADAM zone:

- Total population
- Population over 65
- Total Employment
- Retail Employment (by income level)
- Non-retail employment (by income level)
- High-tech employment
- Households
- Single dwelling units
- Population density
- Employment density
- Median income
- Truck/van travel times to cargo terminals at airports (urban and rural)
- Belly and all-cargo capacities at airports
- Cargo generation propensities by express, general freight and mail categories, based on survey data taken at employment sites and airports
- International air cargo generation by foreign country economic activity (i.e., GNP, employment, income, etc.) and international passengers and air cargo activity at airports

Airport Allocation Module

The RADAM air cargo airport allocation module uses the following primary input parameters to allocate air cargo to exiting and potential future airports in the regional aviation system:

- Truck/van travel time to cargo terminals at airports (peak and off-peak)
- Airport flight portfolio (commuter, short-haul, medium-haul, long-haul, international)
- International flight portfolio by world region served
- Airport hours of operation
- Number of destinations served
- Domestic and international all-cargo operations
- Aircraft fleets and aggregate air cargo capacities
- Load factors for passenger (belly) and all-cargo aircraft
- Availability and cost of on- and off-airport compatible land uses (e.g., warehousing)
- Travel time from airports to intermodal cargo transfer centers
- Existing or potential contractual agreements (through asymmetric logic)

It should be noted that in the cargo allocation process, at passenger airports passenger/belly cargo flights are added until a specified passenger load factor is attained (such as 60%). The RADAM methodology uses a slight lower load factor when there is an excess demand for air cargo since it is assumed that the added belly cargo will make additional passenger flights more feasible.

Defining All-cargo Airport Scenarios

Key Variables and Assumptions

Like previous scenarios that have been defined, aviation system scenarios with all-cargo airports must specify all of the air carrier airports in the system, and any constraints at airports in terms of either passengers served or total operations (per day or year). Any new airports that are assumed to function as all-cargo airports can now be specified since the RADAM model can now simulate their potential effect on regional air cargo distribution. Key input variables that could change allocations to all-cargo airports include data on availability and cost of on- and off-airport cargo-compatible land uses (such as for warehousing) and location of new intermodal transfer centers (i.e., truck and rail transfer centers). It could also be assumed that major shippers and/or carriers will have contractual relationships with particular all-cargo airports in the future, which could substantially increase their allocations.

DEFINING REGIONAL AIRPORT SYSTEM SCENARIOS FOR RADAM ANALYSIS

An Issue Paper for the SCAG Aviation Task Force

3/15/99

The Regional Airport Demand Allocation Model (RADAM) is an exceptionally flexible analytical tool that can be used to evaluate the passenger and cargo distributions among a wide variety of potential regional airport system futures. With its modular structure of systems and subsystems encompassing a great diversity of airport attribute and passenger choice variables, the model is uniquely capable of testing the effects of almost any specific action at an individual airport on passenger and cargo demand distributions within the entire regional system. It can also test a range of assumptions about different regional airport system configurations in the future, including the addition of new commercial airports and major expansion projects (or continuation of capacity constraints) at existing airports.

As described at previous meetings of the Aviation Task Force, RADAM was used last year to evaluate a number of system scenarios under the guidance of the TCC Aviation Subcommittee. These scenarios were differentiated by the following parameters:

- Unconstrained new airports assumed at El Toro, March ARB, NAWS Point Mugu, Palmdale, San Bernardino International (Norton AFB) and Southern California International (George AFB).
- LAX, El Toro Ontario and Burbank constrained and unconstrained
- No El Toro and NAWS Point Mugu
- 2020 population and employment increased by 30% in the service areas of Palmdale, Long Beach and March/SBI airports
- Trip propensities in the Palmdale service area adjusted upward to the San Fernando Valley average

High-speed rail (HSR) service (both 150 MPH and 300 MPH) extended to Palmdale from Union Station, with fare incentives, five-minute headways during peak periods, and shuttle catchment areas with an 8-mile radius around each HSR station

Carry-over work from last year's scope that is planned to be performed this year include a 2020 scenario with no new airports in the Inland Empire and an unconstrained Palm Springs Airport, and a 2020 scenario with an intra-regional MAGLEV HSR system and no El Toro. This year's project budget allows for an additional 10-12 scenarios to be tested, with about half of those to be given a vehicle-miles-traveled (VMT) evaluation for the purpose of estimating their ground access emissions. These additional scenarios will all be defined by the Aviation Task Force. It should be pointed out that the RADAM methodology can now allocate cargo demand as well as passengers, and all-cargo airports can now be added to the scenario mix.

The purpose of this issue paper is to help guide the Task Force in its deliberations on what addition aviation system scenarios will be evaluated by RADAM. An overview is presented of the different parameters, both general and specific, that can be modified or adjusted to differentiate one scenario from another. Potential issues that could be considered by the Task Force in modifying the various scenario parameters is also discussed. The issues discussed below are not meant to constrain the Task Force in defining hypothetical scenarios to be assessed. Rather, they present ideas to be considered in giving various scenarios a “reality check” in evaluating one against another.

General Scenario Parameters that can be Modified

General parameters that can produce major changes or differences between airport system scenarios when modified include the following:

- Number and location of new passenger airports assumed
- Number and location of new all-cargo airports assumed
- Constraints at existing airports assumed (policy or capacity)
- High-speed rail alignments assumed
- Forecast dates

It should be noted that new airports must attract a critical mass of short- and medium-haul demand in order to function as major international airports. Past RADAM modeling indicated that by the year 2020, Ontario and El Toro can reach the level of demand necessary to support international service. Since San Diego County is included in the RADAM service area, and RADAM surveys have recently been completed at Rodriquez Field in Tijuana, the impact of proposals to privatize and upgrade that facility to serve the international needs of San Diego County can now also be tested. It should also be noted that policy constraints are different than capacity constraints since they are established through political or legal decisions, and are not necessarily related to issues of physical capacity of facilities. Capacity constraints can vary widely in terms of enforceability and/or exactness, as further discussed below.

Issues to be Considered in Modifying General Parameters

In deliberating upon the host of scenario alternatives that are possible through changing the general parameters, a number of issues should be considered, including the following:

Would airlines be willing to move to multiple new airports?—As a general rule, the major carriers prefer to concentrate their investments in large hub airports, and are reluctant to duplicate facilities and services at nearby airports. This region already has a large number of air carrier airports (6) which are collectively inadequate to serve the region’s growing air travel demands largely because they are small and/or encroached by urban development. It could be unlikely that airlines will be willing to make major investments in more than one or two new passenger airports in the region over the next twenty years.

Are all-cargo airports feasible?—Around the country, only one all-cargo airport currently supports substantial air cargo activity, which is Rickenbacker Field in Columbus Ohio. It also serves as a truck and rail intermodal distribution facility due to its central location between New York and Chicago. Other all-cargo airports are currently being developed, including Alliance

Airport in Texas and Global Transpark in North Carolina, but their future remains uncertain. However, there are several important emerging trends that favor the eventual success of the all-cargo airport concept. One is the fact that there has been a dramatic shift in cargo carried in the belly holds of passenger planes to all-cargo dedicated freighters (about 60% of the region's cargo is now carried by all-cargo aircraft). Another factor is the increasing shift to deferred (i.e., 2nd and 3rd-day) delivery and intermodal transport, which favors the development of cargo airports in outlying areas with intermodal facilities and room for just-in-time (JIT) manufacturing and warehousing activities adjacent to the airport. Thirdly, the increasing congestion of existing passenger airports is causing worsening problems in getting cargo in and out in a timely fashion, as opposed to the potential efficiencies of airports that specialize in just moving cargo. Because of these and other trends, SCAG's 1997 March AFB Joint Use Feasibility Study found that the base had the highest commercial potential as an all-cargo airport. It should be emphasized, though, that the all-cargo concept is still a relatively uncertain and untested proposition.

Are some policy constraint impermanent or non-binding?—Several airports in the region are subject to policy constraints that may not be considered absolute because they are either impermanent or lack the necessary legal enforcement. These include:

1. Ontario Airport

Ontario Airport is subject to a 12 MAP/125,000 air carrier operations constraint imposed by the State Air Resources Board. This constraint originates from Federal Aviation Law, which stipulates that airports that receive federal funds for runway construction must be certified by the state that they are in to be in compliance with all state and federal air quality standards. In the State of California, this responsibility has been delegated to the State ARB. In 1977 the ARB certified Ontario's new runway at this level, since its existing runway was deemed to have the capacity to accommodate 125,000 operations at 12 MAP. The City of Los Angeles has since contested the constraint, claiming that because of unanticipated growth in all-cargo activity and smaller air carrier aircraft, they won't be able to reach the 12 MAP passenger level with 125,000 air carrier operations. Both parties have put the issue on hold until the airport reaches the 125,000 operations ceiling, which is anticipated to occur within 4-5 years. At that point in time, an air quality mitigation plan will have to be developed and approved for the airport be re-certified (the airport operates under a joint Caltrans/ARB operating permit).

The Ontario air quality constraint is therefore not an absolute growth ceiling, since the airport can be re-certified at a higher growth level with an acceptable mitigation plan. Sacramento Airport is the only other airport in California that is subject to this requirement. The airport is subject to additional mitigations and reporting requirements compared to other airports in order to please the ARB, but it has nevertheless been able to expand to meet rapidly growing aviation demand in the Sacramento Region.

2. Long Beach Airport

In the early 1980's, the City of Long Beach imposed a restriction of 15 air carrier operations/day on Long Beach Airport, which was determined to be consistent with holding noise levels in impacted neighborhoods under the State-mandated 65 CNEL contour. A Federal judge subsequently ruled in favor of the airlines, lifting the cap incrementally to 41 air carrier flights/day. This constraint is still in force, by virtue of a 1995 settlement agreement between the city and the airlines that was prompted by a 1991 Federal circuit of appeals decision to reverse all previous major legal findings. The 41 flights/day cap (21 commuter flights are also allowed) equates to about 2.5-3.0 MAP, depending on the aircraft types, load factors and number of cargo flights assumed (there currently are five all-cargo flights). The airport's noise ordinance was grandfathered in by the 1990 Federal Airport Noise Capacity Act, which precludes new local restrictions on Stage 3 aircraft. The settlement agreement expires in January 1, 2001, after which the two parties (i.e., the City and the airlines) are free to litigate again for greater or lesser restrictions. Most of the major carriers have lost interest in providing service at Long Beach because of its flight limitations and history of adversarial relationships—the airport supported only 0.7 MAP in 1998. However, a new discount carrier, WinAir, has recently initiated 14 flights, and plans to increase its flights to 27 this year, which will bring the airport up to its full 41 flights/day allocation. It should be noted that of all of the policy constraints imposed on airports in the region, Long Beach's appears to be the firmest.

3. John Wayne Airport

Like Long Beach Airport, John Wayne Airport also has a settlement agreement that originated from contentious noise litigation and resulted in airline service restrictions. For John Wayne, it was between the City of Newport Beach (aligned with two citizen groups) and the County of Orange. The agreement, developed in 1985 and due to expire in at the end of 2005, restricts the airport to 8.4 MAP and 73 average daily departures for aircraft generating more than 86 db of single-event noise. The John Wayne passenger constraint does not represent an absolute capacity restriction since it expires at the end of 2005 (although the operations constraint would likely remain in force since it was adopted by County ordinance before 1990). Constraints imposed after 2005 will likely be the subject of further negotiation and/or litigation. The airport is approaching its capacity constraint—it reached 7.7 MAP in 1997—although it dropped to 7.5 MAP in 1998. Airlines at John Wayne are apparently giving priority to maximizing yields as opposed to passenger traffic, and airfares at the airport have climbed as a result (now 27% above the average for the industry). This has prompted many cost-conscious Orange County passengers to turn to out-of-county airport alternatives.

4. Burbank Airport

In 1994, SCAG reviewed FAA's air quality conformity analysis for the Burbank Land Acquisition and Terminal Replacement Project, which forecast a passenger demand of 10 MAP by 2010. Due to a lack of airport-specific information on forecast demand in either the latest air quality management plans (AQMPs) or the operative state implementation plan (SIP), SCAG conducted a separate RADAM analysis for Burbank Airport. It found that 10 MAP was reasonable by 2010 if Burbank expanded its portfolio of medium- and long-haul flights. Along with the fact that expansion of Burbank was consistent with regional policy that called for each subregion to provide adequate capacity to meet its own short-haul demand, a conformity finding for the project was made by SCAG. It could be argued that Burbank is now under a 10 MAP air quality constraint, consistent with this Federal conformity determination. However, at a current service level of about 4.73 MAP (4.9 MAP in 1995), it uncertain whether Burbank will reach 10

MAP by 2010. Also, by that date, a new ozone SIP with update regional aviation forecasts will be in place. Further, a new major federally-funded project would be needed to trigger another conformity determination at Burbank Airport, which is not likely in the next twenty years since Burbank has no major projects planned after the terminal expansion project.

Are airport capacity constraints inexact or ambiguous?—In terms of quantifying the physical capacity impacts of their facilities and surrounding airspace, airports have been likened to long pipes with multiple spigots. Any one of several potential choke points—including curbspace, terminals, gates, rampways, runways, taxiways and airspace—could be capacity limiting factors. Still, it is generally recognized that gate and especially runway capacity are more definitive measure of overall airport capacity, as opposed to "softer" measures such as terminal capacity that are primarily design standards for acceptable passenger convenience and comfort rather than absolute capacity measures. The old passenger terminal at John Wayne, for example, exceeded its design capacity by 4-5 times, with a high level of inconvenience, just before the new terminal opened in 1990. While it is a somewhat harder capacity criterion, airspace capacity is subject to future variation with the ongoing introduction of new technology such as global positioning systems as well as new computer and radar systems. It is also important to recognize that FAA standards for measuring runway capacity, based on instrument flight rule (IFR) procedures, can often be underestimated for airports where visual flight rule (VFR) procedures can be utilized under good weather conditions. Also, measures of gate capacity can underestimate capacity at airports with a large number of discount airlines (such as Southwest) with high gate turnover times, and where it is possible for passengers to walk to airplanes parked on the tarmac.

Be that as it may, the FAA operations estimates for the runway capacity of Ontario and Burbank airports translates to about 20 MAP for each. SCAG's joint use study of March AFB estimates that the capacity of that facility's one runway to be about 10 MAP. The capacity of the current facilities at LAX, without master plan improvements, translates to about 70 MAP, and with master plan improvements, to about 98 MAP (depending on the alternative). The 70 MAP constraint is an airfield constraint that is based on projected fleet mixes and load factors, but with a peaking pattern that is not substantially different than current activity. Without the master plan, and without major new airport alternatives, whether or not LAX will maintain a 70 MAP passenger level is uncertain (the number is currently being reassessed by LAX planning staff). Much like freeways when they approach capacity saturation levels, passenger traffic would be expected to spread to off-peak periods, including more early morning and late night flights. Average load factors per operation would also likely increase in response to passenger demand exceeding available supply.

Over the next year, the aviation system study will further evaluate capacity issues at all of the existing air carrier airports, as well as potential new airports. It is important to also note that the RADAM modeling not only can assume absolute capacity ceiling at individual airports, but also accounts for capacity issues in a relative manner in terms of how passengers react to airports approaching saturation of facilities. As such airports become more inconvenient and expensive to use, RADAM simulates how the passenger airport choice process begins to look more favorably upon less congested airport alternatives.

Are completely unconstrained scenarios unrealistic?—Although it is difficult establish definitive, absolute capacity constraints at individual airports, it could also be unrealistic to assume that all airports in the system can operate in an unconstrained manner in the future. Some airports have legally binding capacity constraints, such as Long Beach Airport, that can be exceeded only through changes in local ordinances and/or new court rulings.

Is there enough information on the feasibility of intra-regional high-speed rail?—In the 1998 RTP, an intraregional MAGLEV HSR system was proposed to connect LAX, El Toro, March ARB, Ontario, San Bernardino Int'l, Southern California Int'l, Palmdale and Burbank airports. In considering RADAM modeling of these and any alternative HSR alignments, it should be recognized that detailed engineering feasibility studies have not yet taken place. Exact alignments, available rights-of-way, location of HSR stations and park-and-ride lots and specific engineering and design issues will be the focus of such studies, which are expected to be initiated in a few months.

How accurate would regional forecasts be past 2020?—It is anticipated that several very long-term RADAM model runs could be made out to the years 2030 or 2040. It should be kept in mind that regional-adopted forecasts, with subregional input, have not yet been developed for these years. Consequently, they would of necessity be developed from extrapolations of 2020 forecasts.

Specific Scenario Parameters that can be Modified

Specific parameters that can produce more individualized or specific changes or differences between airport system scenarios when modified, compared to the general parameters discussed above, include the following:

- Airfares and parking costs
- Parking and terminal convenience
- Mode choice options
- Number of aircraft gates
- Marketing of service
- Employment and population in subregions
- Trip propensities in subregions

For the first four factors above, RADAM either uses actual measured values at existing airports to the extent they are available, or uses default values for what is typical of an airport's size, type of service provided and urban setting. For new airports, default values are assumed. However, new airports built in relatively undeveloped areas are assumed to have greater terminal and parking convenience than existing airports because of opportunities for more efficient design, in combination with a relative lack of congestion (especially in their initial growth stages). Large airports in urban, affluent locations are assumed to have greater variety of mode choice options because of a greater number of hotel vans, taxis and limos. They are also assumed to have more funds devoted to marketing by both the airport and its airlines because of greater overall revenues. It should be noted that RADAM automatically raises air fares for airports that begin to approach their capacity constraints and become more congested. This effect is less for large airports, that have more airline competition because of a larger number of discount airlines and multiple flights to the same destinations.

Issues to be Considered in Modifying Specific Parameters

In deliberating the host of scenario alternatives that are possible through changing the specific parameters, a number of issues should be considered, including the following:

Could changing RADAM existing or default values be unrealistic?—RADAM specific parameters are based actual conditions of existing airports, or what are typical of airports based on their size, type of service provided and urban setting. Assuming otherwise could be unrealistic, such as supposing that a small new airport in an outlying area will have a large marketing budget and/or wide variety of mode choice options. Changing some of these parameters may imply the availability of substantial public subsidies that may not be economically or politically feasible. It could also imply changing the economic behavior of private entities such as airlines and shuttle companies that is largely exempt from government control.

Could modifying employment, population and trip propensities in subregions could produce conflicts with adopted RTP socio-economic forecasts?—One method of boosting demand for under-performing airports that don't compete well against other airports in a future system in terms of attracting passenger or cargo demand is to assume a greater level of population and employment, as well as higher trip propensities, in their local market areas. RADAM socio-economic inputs are from adopted regional forecasts that underpin the RTP, so assuming changes in subregional forecasts implies amending the RTP to be consistent with these changes. If a regional total is adhered to with a different growth distribution, this implies a reduction of growth in some areas to be able to increase growth in others. It also implies a required reprogramming of funds for all transportation projects to be consistent with this new growth distribution, in order to adopt a conforming and technically-defensible RTP. Since the spatial projected emission inventory for the year 2000 Air Quality Management Plan (AQMP) is currently being prepared using the adopted growth distribution, a new distribution could required a revision of this work. It could also require a reorientation of the 2000 AQMP emission control strategy to place more emphasis on the new higher-growth areas (or shift the burden to other air agencies if these areas are in air basins other than the South Coast Air Basin).

Trip propensities are based on adopted socio-economic forecasts in combination with surveyed passenger data. The propensities can be changed for a particular subregion by either assuming different socio-economic forecasts, which implies the potential problems and issues discussed above, or by assuming different propensities per different categories of employment for that particular subregion. The latter poses problems of conflicts with actual surveyed data, and may not be technically defensible. It can be argued that in outlying areas, employment propensities would be higher with substantial airport service provided locally via a major new airport. While this may be true, the argument could be based on circular reasoning: if an airport existed, than it would produce the socio-economic base needed to support an airport.

Phasing of RADAM Scenario Evaluations

As mentioned the RADAM consulting contract allows for the evaluation of about 10-12 additional airport system scenarios. It may be desirable to evaluate scenarios in phases (i.e., 2-3 at a time) with more general scenarios evaluated first, which can be fine-tuned later on. It should be kept in mind that the contract also calls for a vehicle-miles-traveled (VMT) analysis of 5-6 scenarios so that the relative airport ground access emissions (as well as aircraft operations emissions) can be evaluated. Consideration should be given to analyzing scenarios that have VMT minimization potential, including MAGLEV alignments and new airports in currently under-served urban areas. The RADAM modeling work, including documentation of findings, is scheduled to be completed by the end of October, 1999. The objective is to adopt one of the aviation system scenarios for inclusion in the amended RTP. No matter what changes are made to scenario input parameters, each RADAM analysis of each scenario is internally consistent and has its own logical integrity. Only one scenario can be selected, and it would not be technically defensible to combine outputs from separate scenarios. This makes it all the more crucial that scenarios be defined and selected for RADAM evaluation with great forethought and consideration.

RADAM Definitions and Assumptions

General Definitions and Assumptions

Basic Assumptions
Variables
I. Number of Flights by Haul
II. Load Factors
III. Airport Hours of Operation
IV. Flight Portfolio
V. Aircraft Seating
VI. Terminal Capacity
VII. Parking
VIII. Special Generators
IX. High Speed Rail
X. Airfare
XI. Airport Mode Choice Option
XII. Market Incentives

I. Flight haul is defined by duration of flight by passengers. This definition is consistent only expressed in time not miles from the FAA. Passengers use travel time on airplane to length of flight. Travel times are consistent with distance.

Definition By Hours of Flight	Definition by Miles (As per FAA)
0-1 hours: short-haul (SH)	0- 200 miles commuter (as per FAA)
1-2 hours: medium-haul (MH)	0 -600 miles Short Haul
3-4 hours: long-haul (LH)	600 to 1,200 and 1,200 and 1,200 to 1,800 Medium Haul
4+ hours: international (INT)	1,800 to 2,400 Long Haul

II. Load Factors is number of passengers on board an airplane. The following lists proportions which are used across the board in model runs unless specified differently by the scenario parameters. Flights are input in blocks offered by operation haul. These categories are accepted by passengers to varying degrees.

40% for commuters
60% for air carrier domestic
55% for air carrier international medium-haul and long-haul

III. Airport Hours of Operation at each Airport are based on current curfews and operating time of similar size airports for proposed commercial airports. New airport hours of operation are sufficient to accommodate demand at new airports.

Assumed hours of operation at each airport are as follows:

Burbank	14
El Toro	24
John Wayne	14
LAX	24
Long Beach	14
March	24
Ontario	24
Palm Springs	14
Palmdale	24
Point Mugu	16
San Bernardino Int'l	24
Southern Calif. Int'l	24

In the modeling process, actual hours of operation that were assumed for passenger operations at unconstrained airports covered only those periods needed to accommodate forecast demand. Cargo was allowed to operate on a 24-hour basis at unconstrained airports.

IV. Flight portfolio stands for the composition of different flight hauls lengths provided. Scenario definitions could determine flight portfolios. Scenario definitions help determine flight portfolios.

V. Aircraft seating refers to the number of physical seats in an airplane. The following lists airplane seat numbers used in the model runs. Aircraft seating assumptions are being updated based on current data and fleet projections from airports.

Commuter: 28 seats
Short-haul: 78 seats
Medium-haul: 178 seats
Long-haul: 280 seats
International: 280 sets

VI. Terminal capacity looks at square footage (ratio of persons per square ft.), number of gates and convenience. Thus far, scenarios have not test the impact of terminal facilities on passenger demand. Nonetheless, scenarios may be developed in which terminal capacity is an issue. In a terminal capacity scenario, a fixed terminal square footage may be assumed for each system airport.

VII. Parking refers to physical space to park one's car. Parking cost are also considered. In scenarios, parking could be used as an incentive or disincentive. Parking assumptions are:

- All airports are assumed unconstrained parking with a level of service equal to or better than their 1995 peak season demand.
- New and proposed parking terminals are considered.
- Parking costs at existing airports were based on current measured values.

- Parking costs at new airports were based on costs at airports with similar sizes and locations.

VIII. Special Generators are destination locations, which attract large numbers of people. Examples are Disneyland, Universal Studios, and Hollywood.

IX. High-Speed Rail look at different alignments and speeds to airports. Assumption could vary with scenario. The main default assumptions are listed below.

- Theoretical maximum speed 180 mph; actual operational speeds much less due to prolonged upgrades and curves due to topography and frequency of stops in urban areas.
- HSR running every 30 minutes with unconstrained load factors
- Bi-directional service as well as service in only one direction to force passengers to particular airports were run for the RTP alignments
- Only air passengers and persons accompanying them were included
- Extensive, unconstrained shuttle van service to HSR stations were included using a maximum of 7-mile shuttle van radius to collect passengers for HSR service
- HSR to Palmdale was subsidized at 20% less than assumed cost of $35 per person, $30 per person for groups of two or more. Sensitivity to traffic congestion was also increased by 15%, and route reliability by 12%

X. The airfare variable uses comparable average airfares. To date, some scenarios have used 10% discounts on airfare as incentive to use outlying airports. Scenarios can assume different airfares of each airport or identify airfare regionwide.

XI. Airport mode choice variable has more mode choice options for larger airports. Mode choice options for new airports are the same as similar size airports. Mode choice options include up to 14 modes, which encompass conventional modes such as cars and buses, as well as HSR, MAGLEV and other technologies.

<u>Catalytic Demand</u>

The 1998 scenarios were run with and without catalytic demand. The adopted RTP Medium scenario did not have catalytic demand, since it was felt that the additional induced employment implied might be inconsistent with adopted regional socio-economic forecasts. However, it could be unrealistic to assume that a 10 MAP airport would have the same impact on induced growth as an airport at 25 MAP. Thus far, all 1999 defined scenarios have catalytic demand.

<u>Sensitivity to Various RADAM Variables</u>

The 1998 model runs tested the impacts on passenger demand to airports resulting from changes in sensitivity of different categories of passengers to the following variables:

Regional traffic congestion
Terminal congestion at airports
Peak and off-peak travel times to airports

The knowledge of passengers about relative airport attributes, including those of smaller, less well-known airports was also adjusted by modifying the use of asymmetric logic. Sensitivity to these and other factors can be adjusted for future model runs to reflect the fact that passenger sensitivities to and knowledge of various airport factors may change over time.

AVIATION SCENARIOS SELECTED FOR MODELING

Detailed below are the nine (9) regional aviation system scenarios as recommended by the Aviation Task Force for RADAM modeling:

RTP BASELINE
With most airports unconstrained, what is the passenger demand in 2020?
- Burbank constrained to 9.4 MAP
- John Wayne constrained to 8.4 MAP
- All other airports unconstrained

SCENARIO 1
Can Ontario and Inland Empire Airports meet future demand?
Constrain LAX to 70 map and 2 million tons cargo
- Constrain El Toro to 28.8 MAP
- Unconstrain San Bernardino Int'l (Norton), March AFB, Southern California Int'l (George), and Pt. Mugu NAS (includes cargo)
- Constrain Long Beach to 3 MAP
- ONT unconstrained
- Constrain Burbank to 9.7 MAP
- Include market enhancements (to be determined) at the Inland Empire Airports and Palmdale
- Include cataytic demand for cargo (to be determined) at March and Southern California Int'l (George) Airports

SCENARIO 2 (1-A)
What effect does High Speed Rail (HSR) have on Ontario and the Inland Empire Airports ability to meet future demand?
This scenario is identical to Scenario 1, but includes:
- A form of High Speed Rail (HSR) component connecting LAX to ONT and March, consistent with the proposed HSR system.

SCENARIO 3
Can we tighten capacity at LAX and still meet demand?
- Constrain LAX to 60 MAP
- Extend "No Fly" over Inglewood from 11 p.m. to 7 a.m. (from current 12 a.m. to 6:30 a.m.)
- Constrain Burbank to 9.7 MAP
- Constrain John Wayne to 15 MAP
- Constrain Long Beach to 3 AP
- Constrain Palmdale to 7 MAP
- El Toro unconstrained
- ONT unconstrained

SCENARIO 4

Can the region meet future demand with HSR (and no El Toro)?

- Constrain LAX to 70 MAP
- NO El Toro
- All other airports unconstrained
- HSR component linking Orange County (Irvine Center) to March ARB and/or ONT, without linking LAX

SCENARIO 5

What is the air cargo demand based on the RTP Baseline?

- Burbank constrained to 9.4 MAP
- John Wayne constrained to 8.4 MAP
- All other airports unconstrained

SCENARIO 6

Can the existing airport system (with current legal and physical constraints) meet future demand?

- All airports constrained to existing facilities or legal capacity
- No El Toro
- No Point Mugu

SCENARIO 7

What effect will high-speed rail have on the existing airport system's ability to meet future demand?

- This scenario is identical to Scenario 6, but includes a HSR system and an unconstrained Ontario.

SCENARIO 8

What will the addition of El Toro have on the airport system's (with HSR) ability to meeting future demand?

- This scenario is identical to Scenario 7, but includes an unconstrained El Toro.

SCENARIO 9

What effect would the LAX Master Plan improvements have on the Airport System (without El Toro) with HSR?

- This scenario is identical to Scenario 7, but with LAX having master plan improvements.

Market Enhancements Assumed for Scenarios 6-9

Applied to all new airports assumed (unless otherwise indicted) except for El Toro:

- Perceived ground access reliability to Palmdale Airport and Southern California Logistics Airport the same as for other airports
- Future air trip propensities in local service areas increase by 15%
- 100% of all residents and 80% of all non-residents aware of airports as travel choice options. Also, full awareness of Ontario Airport as an international choice option
- Free shuttle service from major activity centers to airports
- Free short-term parking and lower-cost parking at airport compared to other airports in the region

Aviation System Scenarios
Million Annual Passengers (MAP)

Scenarios	Description	BUR	El Toro	John Wayne	LAX	LGB	March	ONT	PSP	PMD	Pt. Mugu	SBD	SCI	Incent	High Speed Rail	Total MAP
1	Can Ontario and Inland Empire airports meet future demand?	9.7 [1]	28.8 [1]	9.50	70.0 [1]	3.00 [2]	1.80	19.90	2.40	1.40	3.20	1.90	0.50	Yes	No	152.10
3	Can we tighten capacity at LAX and still meet demand?	9.7 [1]	32.00	9.80	60.0 [1]	3.00 [2]	1.80	24.30	2.60	2.10	3.30	2.10	0.56	No	No	151.26
4	Can the region meet future demand with HSR (with no El Toro)?	10.20	0.00	28.30	70.0 [1]	4.00	1.90	30.60	1.60	1.10	3.00	2.20	0.40	Yes	Yes	153.30
5	What is the Air Cargo demand based on RTP Baseline (Tons in Millions)?	0.070	1.332	0.026	3.944	0.060	1.001	1.241	0.017	0.017	0.009	0.885	0.300	No	No	8.902 Mil Tons
6	Can the existing Airport System (with current legal and physical constraints) meet future demand?	9.40 [5]	0.00	8.40 [7]	78.01 [7]	3.00 [2]	6.78	20.02 [7]	3.63	3.99 [4]	0.00	6.01	1.60	Yes	No	140.86
7	What effect will HSR have on the existing Airport System's ability to meet future demand?	9.40 [6]	0.00	8.40 [7]	78.01 [7]	3.00 [2]	5.49	35.09	3.24	4.28	0.00	2.95	1.21	Yes	Yes	151.08
The Following Scenarios have been selected for further analysis by the Aviation Task Force.		**BUR**	**El Toro**	**John Wayne**	**LAX**	**LGB**	**March**	**ONT**	**PSP**	**PMD**	**Pt. Mugu**	**SBD**	**SCI**	**Incent**	**High Speed Rail**	**Total MAP**
2	What effect does HSR have on Ontario and Inland Empire airports ability to meet future demand?	9.40 [6]	28.8 [1]	9.40	70.0 [1]	3.00 [2]	1.63	26.10	1.79	1.16	3.03	1.31	0.46	Yes	Yes	156.09
8	What will the addition of El Toro have on Airport System's (with HSR) ability to meet future demand?	9.40 [6]	25.10	8.40 [7]	78.01 [7]	3.00 [2]	1.27	25.58	2.24	1.40	0.00	1.46	0.61	Yes	Yes	156.47
9	What effect would LAX Master Plan improvements have on Airport System (without El Toro) with HSR?	9.40 [6]	0.00	8.40 [7]	86.40	3.00 [2]	5.49	33.80	3.01	1.22	0.00	2.88	1.20	Yes	Yes	154.82
RTP Baseline	With most airports unconstrained, what is demand in 2020?	9.40	22.20	8.40	94.20	2.80	0.90	15.30	1.70	0.10	1.80	1.80	0.10	No	No	157.3 [3]

Footnotes

[1] *Constrained*
[2] *Legally constrained*
[3] *Includes Oxnard Airport*
[4] *Limited to 50 daily operations by Joint Use Agreement (can be expanded to 400 with EIS)*
[5] *Current Terminal*
[6] *New Terminal*
[7] *Physically constrained*

Scenario	Description	BUR	ELT	SNA	LAX	LGB	March	ONT	PSP	PMD	MUG	SBD	SCI	Incent	High Speed Rail	Totals
RTP Baseline	With most airports unconstrained, what is demand in 2025? (in Millions)	9.40	24.79	8.40	102.71	3.02	0.98	16.61	1.83	0.32	2.10	1.94	0.27	No	No	172.4
RTP Air Cargo (in thousands of tons)		74.27	1462.30	26.00	3872.05	66.42	1180.08	1345.23	23.77	0.45	14.73	1000.61	434.09	No	No	9500
RTP Operations (in thousands)		120.37	268.25	121.92	752.59	43.05	37.82	236.00	31.01	17.06	30.22	47.64	23.22	No	No	1729
2	What effect does HSR have on Ontario and Inland Empire airports ability to meet future demand?	9.40	28.80	8.40	70.00	3.00	2.44	34.20	2.28	1.48	3.42	1.99	0.62	Yes	Yes	166.0
SC2 Air Cargo (in thousands of tons)		67.75	1728.02	26.00	2600.94	63.31	1080.47	2489.84	17.76	140.33	229.13	774.88	281.58	Yes	Yes	9500
Scenario 2 Operations (in thousands)		119.36	295.56	120.55	551.55	38.91	55.40	398.12	37.43	24.80	54.52	43.83	16.61	Yes	Yes	1757
8	What will the addition of El Toro have on Airport System's (with HSR) ability to meet future demand?	9.40	29.71	8.40	78.00	3.00	1.72	29.95	2.85	1.73	0.00	1.76	0.8	Yes	Yes	167.3
SC8 Air Cargo (in thousands of tons)		73.21	1693.75	25.29	2975.75	62.97	1079.46	2246.04	19.92	124.44	0.00	878.90	320.28	Yes	Yes	9500
Scenario 8 Operations (in thousands)		112.03	321.10	120.70	660.34	43.62	44.42	366.38	44.81	28.44	0.00	40.36	20.99	Yes	Yes	1803
9	What effect would LAX Master Plan improvements have on Airport System (without El Toro) with HSR?	9.40	0.00	8.40	86.40	3.00	6.99	37.94	3.55	1.56	0.00	5.40	1.50	Yes	Yes	164.1
SC9 Air Cargo (in thousands of tons)		73.398	0.00	33.60	3637.47	66.00	1397.75	3073.42	14.18	147.09	0.00	907.11	149.99	Yes	Yes	9500
Scenario 9 Operations (in thousands)		112.42	0.00	104.45	727.51	44.38	117.56	457.99	51.75	28.07	0.00	90.69	26.16	Yes	Yes	1761
No Project (6)	Can the existing airport system with physical and legal constraints meet future demand?	9.40	0.00	8.40	78.01	3.00	9.52	20.02	4.55	3.99	0.00	8.89	2.08	No	No	147.9
No Project Air Cargo (in thousands of tons)		74.33	0.00	33.60	3354.34	66.06	1617.63	2002.01	29.12	159.60	0.00	1777.96	385.35	No	No	9500
No Project Scenario Operations (in thousands)		112.38	0.00	106.50	620.18	40.73	123.43	208.48	73.18	59.77	0.00	123.82	34.43	No	No	1503

1997; 2025 AVIATION SCENARIOS; PASSENGERS, AIR CARGO AND OPERATIONS

ENVIRONMENTAL JUSTICE ANALYSIS

Income (2020)

	SCAG Region		RTP Medium - Baseline		Scenario 2				Scenario 8				Scenario 9			
	Total	% of Total	Total Affected	% of Total Affected	Total Affected	% of Total Affected	Additional Affected vs. RTP	% of Additional Affected	Total Affected	% of Total Affected	Additional Affected vs. RTP	% of Additional Affected	Total Affected	% of Total Affected	Additional Affected vs. RTP	% of Additional Affected
Total Households	4,953,442		48,879		49,357		478		51,530		2,651		52,866		3,987	
Households Above Poverty	4,387,448	89%	42,788	88%	43,500	88%	712	149%	45,267	88%	2,479	94%	46,240	87%	3,452	87%
Households Below Poverty	565,994	11%	6,091	12%	5,857	12%	-234	-49%	6,263	12%	172	6%	6,626	13%	535	13%

Noise Contours (2020)

	Total Persons	White	Non-white	Latino	Black	Asian/PI	Native Am	Other	Households	Households Below Poverty	Q1	Q2	Q3	Q4	Q5
SCAG Region	21,523,509	6,621,821	14,901,688	10,922,644	1,308,162	2,453,600	152,165	65,117	4,953,442	565,994	990,019	991,134	990,987	990,672	990,691
RTP	234,842	44,604	190,237	150,335	26,363	11,632	1,105	802	48,879	6,091	10,683	11,288	11,139	8,978	6,798
Burbank	20,764	3,283	17,481	15,959	254	1,123	90	55	3,798	403	793	1,035	857	677	437
El Toro	14,737	8,564	6,173	2,902	731	2,320	169	51	4,487	278	595	828	930	975	1,159
John Wayne	2,050	1,576	475	284	78	98	13	2	739	25	58	99	435	82	65
LAX	111,143	10,462	100,681	76,219	19,596	4,156	303	407	27,962	3,857	6,503	6,454	6,131	5,006	3,871
Long Beach	571	366	204	96	26	75	6	1	338	26	51	59	86	69	74
Ontario	55,720	8,008	47,712	43,499	2,381	1,445	219	168	6,958	1,021	1,782	1,794	1,601	1,179	602
March	21,090	8,774	12,315	7,404	2,774	1,834	202	101	2,870	255	510	626	718	674	342
Palmdale	5,892	2,415	3,477	2,774	291	327	74	11	1,022	93	160	219	253	225	167
Palm Springs	1,933	880	1,053	801	105	124	20	3	624	121	209	154	114	78	70
Pt. Mugu															
San Bernardino	942	276	666	397	127	130	9	3	81	12	22	20	14	13	11
Southern California															
Scenario 2	244,841	51,273	193,567	155,197	23,413	12,921	1,209	827	49,357	5,857	10,348	11,350	11,410	9,325	6,925
Burbank	20,987	3,296	17,691	16,153	258	1,133	91	56	3,831	407	801	1,044	865	682	439
El Toro	17,872	10,424	7,448	3,412	816	2,967	192	61	5,483	324	689	970	1,121	1,218	1,485
John Wayne	2,365	1,796	568	338	92	121	15	2	863	32	71	118	479	104	90
LAX	90,171	8,871	81,300	62,484	14,693	3,542	244	337	22,618	2,961	5,061	5,200	5,049	4,141	3,169
Long Beach	566	363	202	95	26	74	6	1	335	26	50	58	85	69	73
Ontario	82,893	14,115	68,780	61,296	4,219	2,658	354	253	11,599	1,623	2,769	2,935	2,704	2,114	1,075
March	21,166	8,806	12,359	7,428	2,785	1,842	203	101	2,883	256	513	628	721	677	344
Palmdale	5,971	2,454	3,517	2,802	296	333	75	11	1,042	95	163	223	258	229	169
Palm Springs	1,933	880	1,053	801	105	124	20	3	624	121	209	154	114	78	70
Pt. Mugu															
San Bernardino	917	268	649	388	123	127	9	2	79	12	22	20	14	13	11
Southern California															
Scenario 8	255,949	51,585	204,362	163,445	25,817	12,998	1,239	863	51,530	6,263	10,986	11,877	11,873	9,689	7,107
Burbank	20,965	3,299	17,666	16,128	258	1,133	91	56	3,833	407	801	1,045	866	683	439
El Toro	16,059	9,341	6,718	3,121	769	2,594	179	55	4,890	296	631	885	1,008	1,074	1,292
John Wayne	2,226	1,698	528	315	86	111	14	2	807	29	65	110	459	94	78
LAX	100,551	9,550	91,000	69,580	16,965	3,815	273	367	25,069	3,392	5,744	5,778	5,555	4,518	3,476
Long Beach	566	363	202	95	26	74	6	1	335	26	50	58	85	69	73
Ontario	85,436	14,870	70,567	62,714	4,393	2,829	367	264	11,928	1,621	2,775	2,966	2,788	2,249	1,150
March	21,139	8,795	12,344	7,420	2,781	1,839	203	101	2,878	256	512	627	720	676	343
Palmdale	5,957	2,445	3,512	2,800	294	332	75	11	1,037	95	162	222	256	228	169
Palm Springs	2,048	935	1,112	845	111	132	21	3	666	128	222	164	121	84	75
Pt. Mugu															
San Bernardino	1,002	289	713	427	134	139	10	3	87	13	24	22	15	14	12
Southern California															
Scenario 9	264,731	52,142	212,587	171,606	26,539	12,339	1,220	883	52,866	6,626	11,362	12,174	12,085	10,174	7,070
Burbank	20,987	3,296	17,691	16,153	258	1,133	91	56	3,831	407	801	1,044	865	682	439
El Toro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
John Wayne	2,157	1,643	513	307	85	105	14	2	772	27	61	105	448	88	71
LAX	100,382	12,074	88,308	66,655	16,717	4,295	276	365	26,831	3,550	5,921	5,987	5,746	5,021	4,157
Long Beach	573	368	206	97	27	75	6	1	339	26	51	59	86	69	74
Ontario	109,685	21,996	87,688	76,586	6,046	4,201	516	339	16,264	2,103	3,567	3,907	3,795	3,283	1,709
March	21,494	8,941	12,552	7,540	2,829	1,874	206	103	2,937	261	522	638	733	691	353
Palmdale	5,971	2,454	3,517	2,802	296	333	75	11	1,042	95	163	223	258	229	169
Palm Springs	2,242	1,029	1,212	919	121	146	23	3	740	140	244	183	134	94	85
Pt. Mugu															
San Bernardino	1,240	341	900	547	160	177	13	3	110	17	32	28	20	17	13
Southern California															

Socio Economic Data for 10 mile radius (2020)

Mile Radius - 2020	Total Persons	White	Non-white	Latino	Black	Asian/PI	Native Am	Other	Households	Households Below Poverty	Q1	Q2	Q3	Q4	Q5
AG Region	21,523,509	6,621,821	14,901,688	10,922,644	1,308,162	2,453,600	152,165	65,117	5,212,493	591,222	1,034,635	1,036,813	1,043,514	1,047,605	1,049,926
Burbank	2,007,015	552,036	1,454,977	1,105,227	61,837	272,216	9,071	6,626	660,020	81,077	141,553	142,656	130,968	115,702	129,155
El Toro	924,342	405,273	519,070	346,374	16,421	149,413	4,762	2,100	269,330	14,442	26,751	40,197	50,782	61,946	89,689
John Wayne	1,631,561	556,051	1,075,510	738,311	26,476	297,780	9,277	3,666	419,391	28,701	53,854	73,787	86,178	94,720	110,863
LAX	2,333,184	380,878	1,952,306	1,245,348	454,947	235,046	7,784	9,181	759,713	116,573	187,932	160,717	141,656	127,792	141,636
Long Beach	576,027	173,713	402,315	237,031	53,376	105,598	4,486	1,824	221,295	28,564	48,952	46,534	45,789	43,460	36,565
Ontario	1,271,474	437,705	833,769	628,890	102,450	88,076	8,168	6,185	232,060	21,561	38,966	43,962	50,516	55,770	42,822
March	678,875	268,719	410,156	263,761	80,716	56,814	6,400	2,465	93,710	9,140	16,554	18,036	20,746	22,980	15,392
Palmdale	351,816	168,834	182,983	132,287	21,889	23,150	4,648	1,009	82,502	7,981	13,451	14,039	19,915	21,224	13,881
Palm Springs	166,833	95,315	71,518	57,951	4,942	6,443	1,869	313	48,503	7,217	12,877	11,486	8,951	7,539	7,644
Pt. Mugu	357,389	110,377	247,012	195,275	12,726	35,524	2,615	872	69,537	5,174	10,558	14,394	15,252	16,556	12,783
San Bernardino	1,029,663	351,251	678,412	476,304	123,120	66,094	9,598	3,296	188,021	26,994	46,397	42,621	41,307	35,440	22,258
Southern California	171,139	81,110	90,030	58,614	19,418	9,201	2,313	484	28,390	3,943	7,344	7,159	6,512	4,682	2,692
AG Region	100%	31%	69%	51%	6%	11%	1%	0%	24%	3%	5%	5%	5%	5%	5%
Burbank	100%	28%	72%	55%	3%	14%	0%	0%	33%	4%	7%	7%	7%	6%	6%
El Toro	100%	44%	56%	37%	2%	16%	1%	0%	29%	2%	3%	4%	5%	7%	10%
John Wayne	100%	34%	66%	45%	2%	18%	1%	0%	26%	2%	3%	5%	5%	6%	7%
LAX	100%	16%	84%	53%	19%	10%	0%	0%	33%	5%	8%	7%	6%	5%	6%
Long Beach	100%	30%	70%	41%	9%	18%	1%	0%	38%	5%	8%	8%	8%	8%	6%
Ontario	100%	34%	66%	49%	8%	7%	1%	0%	18%	2%	3%	3%	4%	4%	3%
March	100%	40%	60%	39%	12%	8%	1%	0%	14%	1%	2%	3%	3%	3%	2%
Palmdale	100%	48%	52%	38%	6%	7%	1%	0%	23%	2%	4%	4%	6%	6%	4%
Palm Springs	100%	57%	43%	35%	3%	4%	1%	0%	29%	4%	8%	7%	5%	5%	5%
Pt. Mugu	100%	31%	69%	55%	4%	10%	1%	0%	19%	1%	3%	4%	4%	5%	4%
San Bernardino	100%	34%	66%	46%	12%	6%	1%	0%	18%	3%	5%	4%	4%	3%	2%
Southern California	100%	47%	53%	34%	11%	5%	1%	0%	17%	2%	4%	4%	4%	3%	2%

Noise Contours (2020)

E CONTOURS - 2020	Total Persons	White	Non-white	Latino	Black	Asian/PI	Native Am	Other	Households	Households Below Poverty	Q1	Q2	Q3	Q4
G Region	100%	31%	69%	51%	6%	11%	1%	0%	100%	11%	20%	20%	20%	20%
RTP	100%	19%	81%	64%	11%	5%	0%	0%	100%	12%	22%	23%	23%	18%
Burbank	100%	16%	84%	77%	1%	5%	0%	0%	100%	11%	21%	27%	23%	18%
El Toro	100%	58%	42%	20%	5%	16%	1%	0%	100%	6%	13%	18%	21%	22%
John Wayne	100%	77%	23%	14%	4%	5%	1%	0%	100%	3%	8%	13%	59%	11%
LAX	100%	9%	91%	69%	18%	4%	0%	0%	100%	14%	23%	23%	22%	18%
Long Beach	100%	64%	36%	17%	5%	13%	1%	0%	100%	8%	15%	17%	25%	20%
Ontario	100%	14%	86%	78%	4%	3%	0%	0%	100%	15%	26%	26%	23%	17%
March	100%	42%	58%	35%	13%	9%	1%	0%	100%	9%	18%	22%	25%	23%
Palmdale	100%	41%	59%	47%	5%	6%	1%	0%	100%	9%	16%	21%	25%	22%
Palm Springs	100%	46%	54%	41%	5%	6%	1%	0%	100%	19%	33%	25%	18%	13%
Pt. Mugu														
San Bernardino	100%	29%	71%	42%	13%	14%	1%	0%	100%	15%	27%	25%	17%	16%
Southern California														
Scenario 2	100%	21%	79%	63%	10%	5%	0%	0%	100%	12%	21%	23%	23%	19%
Burbank	100%	16%	84%	77%	1%	5%	0%	0%	100%	11%	21%	27%	23%	18%
El Toro	100%	58%	42%	19%	5%	17%	1%	0%	100%	6%	13%	18%	20%	22%
John Wayne	100%	76%	24%	14%	4%	5%	1%	0%	100%	4%	8%	14%	56%	12%
LAX	100%	10%	90%	69%	16%	4%	0%	0%	100%	13%	22%	23%	22%	18%
Long Beach	100%	64%	36%	17%	5%	13%	1%	0%	100%	8%	15%	17%	25%	21%
Ontario	100%	17%	83%	74%	5%	3%	0%	0%	100%	14%	24%	25%	23%	18%
March	100%	42%	58%	35%	13%	9%	1%	0%	100%	9%	18%	22%	25%	23%
Palmdale	100%	41%	59%	47%	5%	6%	1%	0%	100%	9%	16%	21%	25%	22%
Palm Springs	100%	46%	54%	41%	5%	6%	1%	0%	100%	19%	33%	25%	18%	13%
Pt. Mugu														
San Bernardino	100%	29%	71%	42%	13%	14%	1%	0%	100%	15%	28%	25%	18%	16%
Southern California														
Scenario 8	100%	20%	80%	64%	10%	5%	0%	0%	100%	12%	21%	23%	23%	19%
Burbank	100%	16%	84%	77%	1%	5%	0%	0%	100%	11%	21%	27%	23%	18%
El Toro	100%	58%	42%	19%	5%	16%	1%	0%	100%	6%	13%	18%	21%	22%
John Wayne	100%	76%	24%	14%	4%	5%	1%	0%	100%	4%	8%	14%	57%	12%
LAX	100%	9%	91%	69%	17%	4%	0%	0%	100%	14%	23%	23%	22%	18%
Long Beach	100%	64%	36%	17%	5%	13%	1%	0%	100%	8%	15%	17%	25%	21%
Ontario	100%	17%	83%	73%	5%	3%	0%	0%	100%	14%	23%	25%	23%	19%
March	100%	42%	58%	35%	13%	9%	1%	0%	100%	9%	18%	22%	25%	23%
Palmdale	100%	41%	59%	47%	5%	6%	1%	0%	100%	9%	16%	21%	25%	22%
Palm Springs	100%	46%	54%	41%	5%	6%	1%	0%	100%	19%	33%	25%	18%	13%
Pt. Mugu														
San Bernardino	100%	29%	71%	43%	13%	14%	1%	0%	100%	15%	28%	25%	17%	16%
Southern California														
Scenario 9	100%	20%	80%	65%	10%	5%	0%	0%	100%	13%	21%	23%	23%	19%
Burbank	100%	16%	84%	77%	1%	5%	0%	0%	100%	11%	21%	27%	23%	18%
El Toro														
John Wayne	100%	76%	24%	14%	4%	5%	1%	0%	100%	3%	8%	14%	58%	11%
LAX	100%	12%	88%	66%	17%	4%	0%	0%	100%	13%	22%	22%	21%	19%
Long Beach	100%	64%	36%	17%	5%	13%	1%	0%	100%	8%	15%	17%	25%	20%
Ontario	100%	20%	80%	70%	6%	4%	0%	0%	100%	13%	22%	24%	23%	20%
March	100%	42%	58%	35%	13%	9%	1%	0%	100%	9%	18%	22%	25%	24%
Palmdale	100%	41%	59%	47%	5%	6%	1%	0%	100%	9%	16%	21%	25%	22%
Palm Springs	100%	46%	54%	41%	5%	7%	1%	0%	100%	19%	33%	25%	18%	13%
Pt. Mugu														
San Bernardino	100%	28%	73%	44%	13%	14%	1%	0%	100%	15%	29%	25%	18%	15%
Southern California														

SOUTHERN CALIFORNIA
AVIATION INDUSTRY IMPACT ANALYSIS

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SOUTHERN CALIFORNIA AVIATION INDUSTRY IMPACT ANALYSIS

EXECUTIVE SUMMARY

CIC Research, Inc., was retained by the Southern California Association of Governments (SCAG) to prepare an impact analysis of the Southern California aviation industry on the regional economy in the year 2020. For this study SCAG prepared a baseline 2020 aviation activity forecast (RTP-Medium) and four alternative forecast scenarios. The RTP-Medium scenario is a forecast for 157 million annual air passengers and 8.9 million tons of air cargo for the year 2020. This level of aviation activity represents a 92 percent increase in passenger volume and a 242 percent increase in air cargo tonnage from 1998.

The passenger and cargo volumes for each aviation forecast scenario were then allocated among the regional airports based on transportation demand modeling and analysis prepared by Advanced Transportation Systems. To quantify the resulting economic impacts of the aviation forecast scenarios, CIC designed a regional input-output model with projections of output and employment for the local economy in the year 2020. The following are the major findings of CIC's economic impact analysis.

STUDY FINDINGS

↓# For 1998, employment in the aviation transportation sector of the six-county SCAG region was estimated at 66,000 jobs (0.8%) of the region's total of 8,240,000 jobs.

↓# Total sales of the air transportation sector in 1998 were about $7.4 billion (0.9%) of the region-wide total output of $801 billion.

↓# Based on regional projections of employment growth and productivity, the six-county SCAG economy will be about 66% larger in terms of employment than it is today, with about 13,750,000 total jobs in 2020.

↓# Total output of the SCAG region will grow in real terms an estimated 117% to about $1.7 trillion in 2020 (measured in 1998 $s).

↓# Sales of the aviation industry or more accurately air transportation services will reach $18.7 billion, representing about 1.1% of the output of the regional economy in 2020.

↓# Employment within the air transportation services sector will encompass about 110,000 jobs or about 0.8% of the total employment within the SCAG region in the year 2020.

↓# For the purposes of this analysis, the economic impacts of air transportation services (i.e., airports, passenger carriers, and cargo carriers) are measured at three levels:

1) air transportation service providers (i.e., the air transportation sector)
2) non-resident air traveler expenditures in the region; and
3) linkage to locally produced goods and services that are exported by air.

Each successive level of impact comprises greater levels of economic activity that are not solely dependent upon the air transportation services of the SCAG region.

SUMMARY OF LEVEL 1, 2, AND 3 SCAG REGION ECONOMIC IMPACTS FOR FIVE ALTERNATIVE 2020 AVIATION DEVELOPMENT SCENARIOS
(Dollar Amounts Stated in 1998 $Millions)

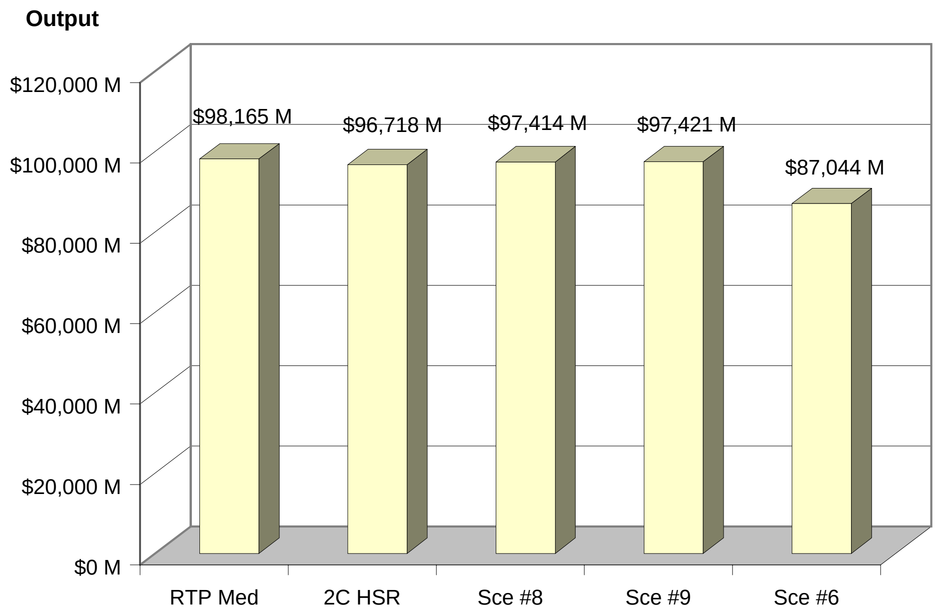
Economic Impact Estimates (Direct, Indirect, and Induced)	2020 Aviation Services Impact Scenarios				
	RTP Med	2C HSR	Sce #8	Sce #9	Sce #6
Level 1 - Air Transportation Services (Only)					
Output	$30,068 M	$29,815 M	$29,888 M	$29,573 M	$26,904 M
Income	$12,167 M	$12,070 M	$12,098 M	$11,977 M	$10,957 M
Employment	191,080	189,476	189,938	187,935	170,978
Indirect Business Taxes	$1,304 M	$1,293 M	$1,296 M	$1,283 M	$1,167 M
Level-2 Non-Resident Air Travelers (Only)					
Output	$31,397 M	$30,510 M	$31,045 M	$31,752 M	$27,300 M
Income	$10,907 M	$10,625 M	$10,801 M	$11,029 M	$9,577 M
Employment	348,471	338,808	344,787	352,566	303,164
Indirect Business Taxes	$2,559 M	$2,482 M	$2,525 M	$2,584 M	$2,221 M
Combined Levels-1, 2: Air Transportation Services and Non-Resident Air Traveler Impacts					
Output	$61,465 M	$60,325 M	$60,933 M	$61,325 M	$54,205 M
Income	$23,074 M	$22,695 M	$22,899 M	$23,006 M	$20,534 M
Employment	539,551	528,284	534,725	540,501	474,141
Indirect Business Taxes	$3,863 M	$3,776 M	$3,821 M	$3,867 M	$3,388 M
Level-3 Economic Impacts Derived From Air Transportation Of Locally Produced Foreign Exports (Only)					
Output	$36,700 M	$36,392 M	$36,481 M	$36,096 M	$32,839 M
Income	$12,243 M	$12,146 M	$12,174 M	$12,053 M	$11,025 M
Employment	166,736	165,336	165,739	163,991	149,194
Indirect Business Taxes	$1,147 M	$1,137 M	$1,140 M	$1,128 M	$1,026 M
Combined Levels-1, 2, 3: Air Transportation Services, Non-Resident Air Travelers, and Locally Produced Air Exports					
Output	$98,165 M	$96,718 M	$97,414 M	$97,421 M	$87,044 M
Income	$35,317 M	$34,841 M	$35,073 M	$35,059 M	$31,559 M
Employment	706,287	693,620	700,464	704,492	623,336
Indirect Business Taxes	$5,010 M	$4,913 M	$4,962 M	$4,995 M	$4,415 M

Source: CIC Research, Inc.

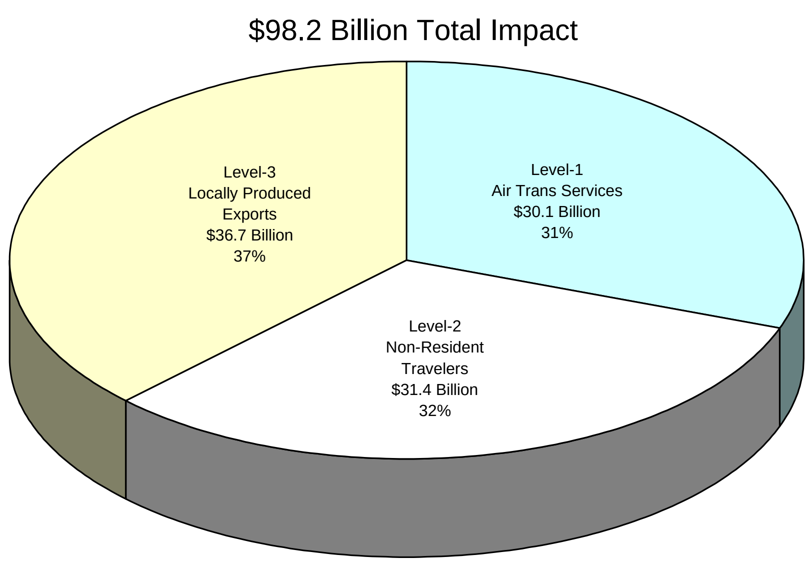
↓# As can be seen from the results of the five scenarios, the impact estimates are very similar with the exception of Scenario 6. A difference of about 2% in total output or employment exists for the first four listed scenarios. This is not too surprising in that the scenarios are very similar in total passenger volume and cargo shipments. However, Scenario 6 is constrained to about 140 MAP compared to 157 MAP for the RTP-Medium Scenario. As a result, Scenario 6 generates about 11.4% less economic impact for the region and 11.8% fewer jobs (-$11.2 billion and –83,000 jobs, respectively).

↓# The overall total impact estimate of $98.2 billion (RTP-Medium) indicates that the air transportation sector will support nearly 6% of the total regional economic activity and about 5% of the total regional employment.

COMBINED TOTAL LEVELS-1, 2, AND 3 SCAG REGION ECONOMIC IMPACTS FOR FIVE ALTERNATIVE 2020 AVIATION DEVELOPMENT SCENARIOS
(Dollar Amounts Stated in 1998 $Millions)



SCAG REGION 2020 RTP-MEDIUM AVIATION FORECAST SCENARIO LEVELS OF ECONOMIC IMPACT



↓# The Level-1: Air transportation Services economic impacts represent about $30.1 billion (31%) of the total $98 billion in economic activity supported by the aviation industry within the SCAG region. Level-1 impacts represent the most conservative measure of the value of air transportation services to the regional economy and the greatest association of direct cause and effect.

↓# The Level-2: Non-resident air traveler expenditure impacts represent about $31.4 billion (32%) of the total $98 billion in economic activity supported by the aviation industry within the SCAG region. The Level-3: Impacts of locally produced foreign exports represent about $36.7 billion (37%) of the total $98 billion in economic activity.

↓# With each additional level of impacts there is less and less association of cause and effect for the total level of economic activity (direct, indirect, and induced) supported by the region's air transportation services. While the estimates of total economic activity associated with air transportation services are reasonable, there is greater opportunity for substitution effects with reliance on alternative modes of transportation.

↓# There are substantial catalytic impacts that will likely result from the development of new commercial airports and the major expansions of existing airports under the alternative aviation scenario forecasts. These catalytic impacts which are generated by new business activity attracted to an airport area are difficult to quantify. Estimates of the potential catalytic impacts of the 2020 RTP development scenarios were not generated as part of the workscope for this study.

Suggestions For Additional Study and Analysis

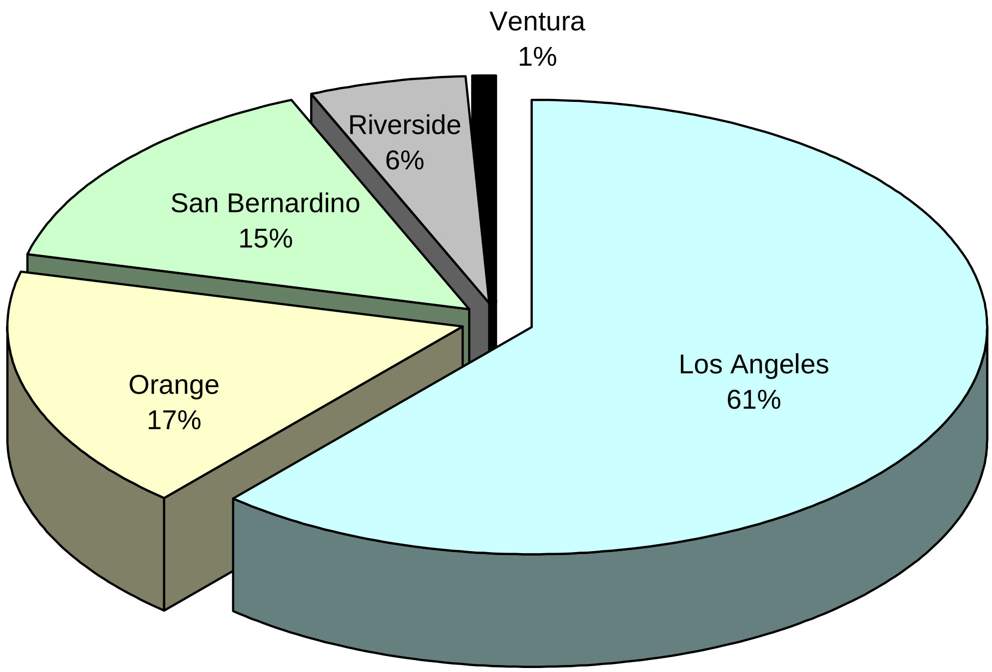
↓# Additional study is needed on the substitution effects of all available transportation options. The RADAM model for allocation of transportation demand (passengers and cargo) could provide a framework for analysis of transportation mode substitution and all potential mixes of transportation modes based on pricing, access, and service levels. This would help to provide better insight to the degree of influence associated with the Level-2 and Level-3 measures of economic impacts.

↓# Additional study is recommended related to capital investment, industry clusters, and catalytic economic impacts. These impacts would result from the expansion of the region's aviation infrastructure and service levels (domestic and international). This type of analysis could provide valuable guidance for long-term regional transportation planning and economic development.

Regionwide v. County Level Economic Impacts

↓# Although the region-wide economic impacts show little variation between scenarios, there are much greater impact variations between scenarios by County, at least for Level-1, *i.e.*, Transportation Services production. However, Level-2 and Level-3 economic impacts are much more dispersed within the regional economy. As a result very small differences in county-level impacts would occur for Level-2: Non-resident air traveler impacts, and Level-3: Foreign exports of locally produced goods. The in-region origin and destination of air travelers and foreign exports of locally produced goods demonstrates very little change dependent upon airport usage. This result is strongly supported by the results of the RADAM aviation demand allocation modeling.

2020 RTP MEDIUM SCENARIO FORECAST
EMPLOYMENT IMPACTS OF AIR TRANSPORTATION SERVICES BY COUNTY
(191,000 Total Jobs)



↓# For each of the alternative aviation development scenarios the resulting economic impacts by county represent two percent or less of each respective county economy. Even though the impact of Scenario 2C-HSR has seven times the impact of Scenario 9 on the Orange County economy, the resulting increase in 37,600 jobs (44,100 jobs v. 6,500 jobs), still represents only about 1.5 percent of the total countywide employment in 2020. Therefore, while there are measurable differences in the relative county-level impacts of the alternative regional aviation forecasts, the resulting impact levels do not represent a substantial economic loss or benefit to the individual counties.

↓# Under each scenario, including the RTP baseline, Los Angeles County airports would account for a much smaller percentage of the region's total air transportation services. The largest increases in other counties air transportation services would be in the greatly expanding air cargo markets. By 2020 airports located in Los Angeles county will still account for as much as two-thirds of total air passengers in the SCAG region (RTP-Medium), but less than half of total regional air cargo.

↓# Under scenarios where a new Orange County international airport is developed at El Toro, Orange County would become the primary reliever for expanding air passengers. Under all of the scenarios, there are greatly expanded air cargo services offered in San Bernardino and Riverside Counties.

LEVEL-1 ECONOMIC IMPACTS OF AIR TRANSPORTATION SERVICES BY COUNTY FOR FIVE SELECTED 2020 AVIATION DEVELOPMENT SCENARIOS

(Dollar Amounts Stated in 1998 $Millions)

Impact Category/ County	SCE RTP	SCE 2C HSR	SCE 8	SCE 9	SCE 6
Output Impact:					
Los Angeles	$18,487 M	$13,883 M	$15,572 M	$17,160 M	$16,391 M
Orange	$5,196 M	$6,935 M	$5,939 M	$1,024 M	$2,231 M
San Bernardino	$4,424 M	$6,628 M	$6,471 M	$8,490 M	$5,359 M
Riverside	$1,749 M	$1,814 M	$1,905 M	$2,898 M	$2,915 M
Ventura	$212 M	$555 M	$0 M	$0 M	$8 M
Total	$30,068 M	$29,815 M	$29,888 M	$29,573 M	$26,904 M
Income Impact:					
Los Angeles	$7,481 M	$5,620 M	$6,303 M	$6,950 M	$6,675 M
Orange	$2,102 M	$2,807 M	$2,404 M	$415 M	$908 M
San Bernardino	$1,790 M	$2,683 M	$2,619 M	$3,439 M	$2,183 M
Riverside	$708 M	$735 M	$771 M	$1,174 M	$1,187 M
Ventura	$86 M	$225 M	$0 M	$0 M	$3 M
Total	$12,167 M	$12,070 M	$12,098 M	$11,977 M	$10,957 M
Tax Revenue Impact:					
Los Angeles	$802 M	$602 M	$675 M	$744 M	$711 M
Orange	$225 M	$301 M	$258 M	$44 M	$97 M
San Bernardino	$192 M	$287 M	$281 M	$368 M	$232 M
Riverside	$76 M	$79 M	$83 M	$126 M	$126 M
Ventura	$9 M	$24 M	$0 M	$0 M	$0 M
Total	$1,304 M	$1,293 M	$1,296 M	$1,283 M	$1,167 M
Employment Impact:					
Los Angeles	117,485	88,228	98,963	109,052	104,166
Orange	33,020	44,071	37,742	6,508	14,177
San Bernardino	28,114	42,122	41,125	53,955	34,058
Riverside	11,117	11,531	12,108	18,420	18,523
Ventura	1,344	3,524	-	-	52
Total	191,080	189,476	189,938	187,935	170,978
Percentage Of County Employment:					
Los Angeles	1.6%	1.2%	1.4%	1.5%	1.4%
Orange	1.1%	1.4%	1.2%	0.2%	0.5%
S.B. / Riverside	1.5%	2.1%	2.1%	2.8%	2.0%
Ventura	0.2%	0.5%	0.0%	0.0%	0.0%
Total	1.4%	1.4%	1.4%	1.4%	1.2%

Source: CIC Research, Inc.

↓# The greatest redistribution of air transportation services would take place under the high-speed rail scenario 2C HSR. The least redistribution of air transportation services would take place under scenario 6, which because of existing constraints, would also result in an smaller overall growth in both Los Angeles and Orange Counties, as well as for the region as a whole.

↓# The largest difference for any county between one scenario condition and the others is the development of an international airport at El Toro. This development is present in the scenarios RTP-Medium, 2C HSR and Scenario 8. It is not present in Scenario 9 and Scenario 6. With El Toro, and high-speed rail (HSR) the greatest reduction in Los Angeles County economic impact is obtained (Scenario 2C HSR). Without El Toro but with HSR (Scenario 9), the lower level of Orange County economic impacts occur due to a substantial expansion in air service within San Bernardino County. This is also the only scenario in which a county that presently offers a substantive level of air transportation services would experience an actual reduction in total economic impact.

Final Study Conclusions

↓# The largest difference in terms of economic impacts for the aviation forecast scenarios exists between the RTP-Medium and Scenario 6. This difference equals about $11.2 billion in total regional output and 83,000 jobs. While on the surface these may seen like fairly large impacts, the total 2020 regional economy will generate about $1.7 trillion in output and 13,750,000 total jobs. Therefore, the differences between the RTP-Medium scenario and Scenario 6 represents a little more than one half of one percent of the regional economy in 2020.

↓# Given the relatively small differences in overall economic impacts, it would seem likely that the planning decisions among the alternative regional aviation development scenarios may be more strategically related to environmental and transportation congestion impacts (air and ground) rather than the future economic impacts.

INTRODUCTION

CIC Research, Inc. has prepared this economic analysis of the Southern California aviation industry under contract to the Southern California Association of Governments (SCAG). The SCAG region includes the six counties of Ventura, Los Angeles, San Bernardino, Riverside, Orange, and Imperial. For the purposes of this study, Southern California is defined as the six-county SCAG region plus San Diego County. The planning horizon for SCAG is the year 2020 for each of the alternative air transportation development scenarios. SCAG was responsible for providing CIC Research, Inc. with the alternative air transportation forecast scenarios, including detailed air passenger and air cargo forecasts.[1] CIC Research was then responsible for estimating the resulting economic impacts for each of the 2020 forecast alternatives. The economic impacts in this report are detailed for each of the counties, as well as a SCAG region total.

BACKGROUND

During the next 20 years, the SCAG region's population is projected to increase by 6.4 million to a total of over 22.4 million. Total employment during the same period is projected to increase by 3.9 million jobs to a total of 10.5 million. This growth will add to what is already regarded as a highly congested regional transportation system, including air transportation. The region's airports served 81.9 million annual passengers (MAP) in 1998 and handled 2.6 million tons of cargo. The demand for aviation services is projected to reach 157 MAP and 8.9 million cargo tons by the year 2020.[2] This rapid expansion raises a number of issues about the supply side of the air transportation industry, including questions about the capacity of existing airports and the associated congestion in the air and on the ground. Generally speaking, the issues aim at finding the best way to meet demand, in terms of the evolving future configuration of airport traffic, and what value to the region's economy does each possible growth path represent.

A number of decisions will have to be made during the next few years that will effect the future not only of the Aviation Industry but by extension, the spatial distribution of the growth in businesses and population in the region. The decisions and their outcomes will also be

[1] Air passenger and air cargo forecasts for the 2020 Regional Transportation Plan were generated by SCAG and then allocated to regional airports by Advanced Transportation Systems' RADAM model under a separate contract.

impacted by other decisions, including those made in adjacent areas. For example, San Diego County, which is sandwiched between the SCAG region and Baja California, Mexico, is also in the process of planning for 20 MAP if constrained and up to 28 MAP if unconstrained. Currently, Lindbergh Field (SAN) serves 14.8 MAP and 118,000 tons of cargo, which is about two thirds of San Diego's air passenger demand and twenty percent of its air cargo.[3] In addition, 12 airports were recently privatized in Mexico, including the Tijuana Rodriguez Field. The new ownership of the Tijuana airport is seriously considering a cross-border international terminal link in the U.S. which could add additional international long-haul capacity to the Southern California region.

NATIONAL AND REGIONAL AVIATION PERSPECTIVE

It is helpful to understand the relative size of the aviation industry in Southern California (including San Diego County) compared with the Nation and the State of California. Due to the way in which national aviation statistics are compiled, it is easier to compare air passenger enplanements (i.e., departing passengers boarded on planes) at Southern California, California, and U.S. airports.

Air Passenger Enplanements

There were a total of 660 million air passenger enplanements for U.S. airports in 1998. In comparison, the were 82.2 million total enplanements for California airports, and there were 47.8 million enplanements within Southern California. California represents about 13 percent of the U.S. total enplanements and Southern California represents about 7 percent. The Los Angeles International Airport (LAX) dominates air transportation in both the Southern California region and the state as a whole. LAX accounts for over one third (37%) of the state's total passenger enplanements and Southern California (including LAX) accounts for more than half (58%) of passenger enplanements in California.

[2] CommunityLink 21: Regional Transportation Plan, Southern California Association of Governments, 1998.
[3] Advanced Transportation Systems, "March Air Force Base Joint Use Feasibility Study, Appendix A: Lindbergh Field & San Diego County. Southern California Association of Governments, 1997.

Table 1

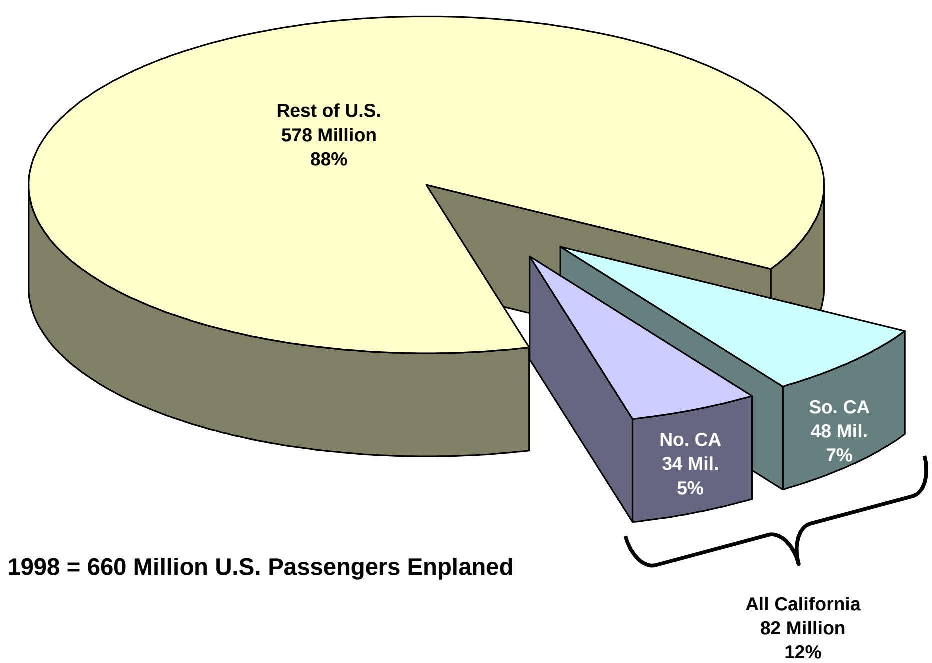
TOTAL 1998 PASSENGER ENPLANEMENTS

Airport	Enplanements	Percentage of State	Percentage of US Total
Los Angeles International (LAX)	30,191,000	36.7%	4.6%
San Diego International (SAN)	7,436,000	9.1%	1.1%
John Wayne (SNA)	3,642,000	4.4%	0.6%
Ontario (ONT)	3,201,000	3.9%	0.5%
Burbank-Glendale-Pasadena (BUR)	2,360,000	2.9%	0.4%
Palm Springs (PSP)	584,000	0.7%	0.1%
Long Beach (LBA)	301,000	0.4%	0.0%
Southern California All Airports Total	47,812,000	58.2%	7.2%
State Total	82,155,000	100.0%	12.5%
US Total	659,659,000		100.0%

Source: : FAA DOT/TSC CY1998 ACAIS Database.

Figure 1

TOTAL 1998 U.S. PASSENGER ENPLANEMENTS



Source : FAA DOT/TSC CY1998 ACAIS Database

Air Cargo Tonnage

LAX dominance is also evident with respect to air cargo. Approximately 39 percent of all domestic air cargo enplaned in the state is shipped out of LAX, while 63 percent of all air cargo enplaned (including air exports) in the state is shipped out of Southern California. Nationally, Southern California contributes over 8 percent of the total air cargo enplaned, with LAX contributing over 4 percent by itself with just domestic air cargo. Air cargo shipped out of California airports make up over 13 percent of the 15 million tons enplaned in the United States in 1998.[4]

Table 2

TOTAL TONS OF AIR CARGO SHIPPED DURING 1998

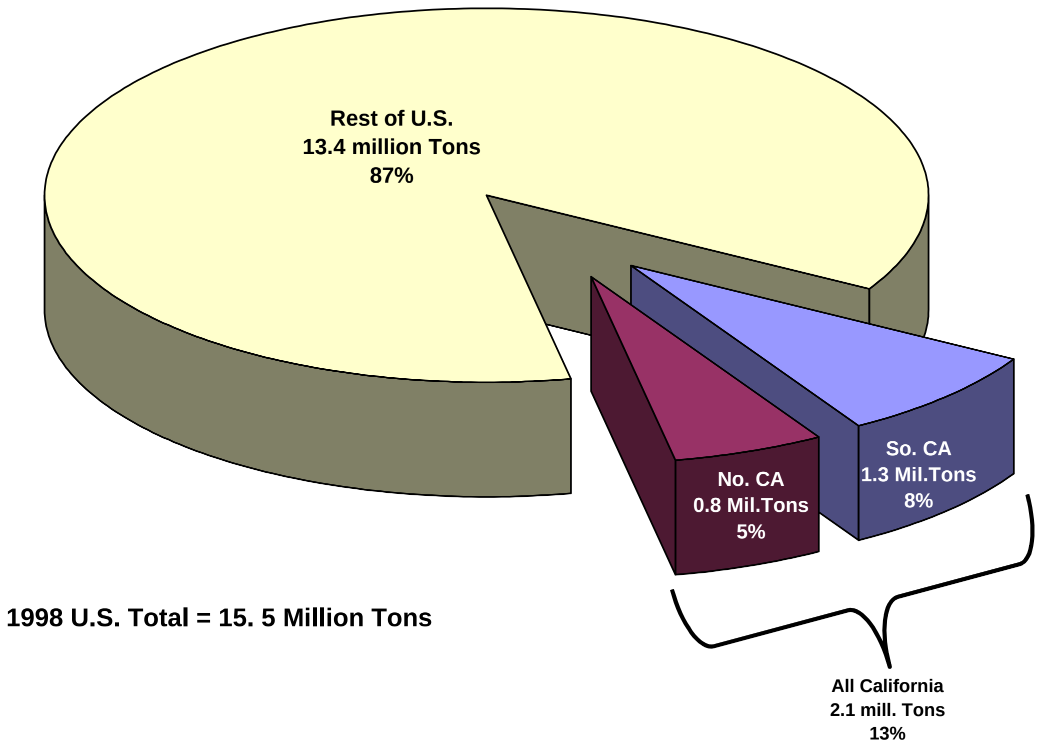
Airport / Region	Thousands of Tons	Percentage of State	Percentage of US Total
Domestic Cargo Enplanements			
Los Angeles International (LAX)	686.1	33.3%	4.4%
Ontario (ONT)	213.4	10.4%	1.4%
San Diego International (SAN)	61.4	3.0%	0.4%
John Wayne (SNA)	21.5	1.0%	0.1%
Burbank-Glendale-Pasadena (BUR)	17.5	0.8%	0.1%
Long Beach (LBA)	15.1	0.7%	0.1%
Palm Springs (PSP)	0.1	0.0%	0.0%
Domestic Southern California Cargo	1,014.9	49.3%	6.6%
Southern California Exports	285.4	13.9%	1.8%
Total Southern California Cargo Enplanements	**1,300.3**	**63.1%**	**8.4%**
California Domestic Cargo	1,745.6	84.7%	11.3%
Califonia Exports	314.3	15.3%	2.0%
Total California Cargo Enplanements	**2,059.9**	**100.0%**	**13.3%**
US Domestic Cargo	12,776.0		82.7%
US Exports	2,681.3		17.3%
Total US Cargo Enplanements	**15,457.3**		**100.0%**

Source : “Schedule: T3 - Airport Activity Statistics”, U.S. Department of Transportation,
Bureau of Transportation Statistics, Office of Airline Information
Department of Commerce, Bureau of the Census

[4] All cargo airports are defined by the FAA as airports that in addition to any other air transportation services available, are served by aircraft providing air transportation of only cargo with a total annual landed weight of more than 100 million pounds.

Figure 2

Total Tons of Air Cargo Shipped During 1998

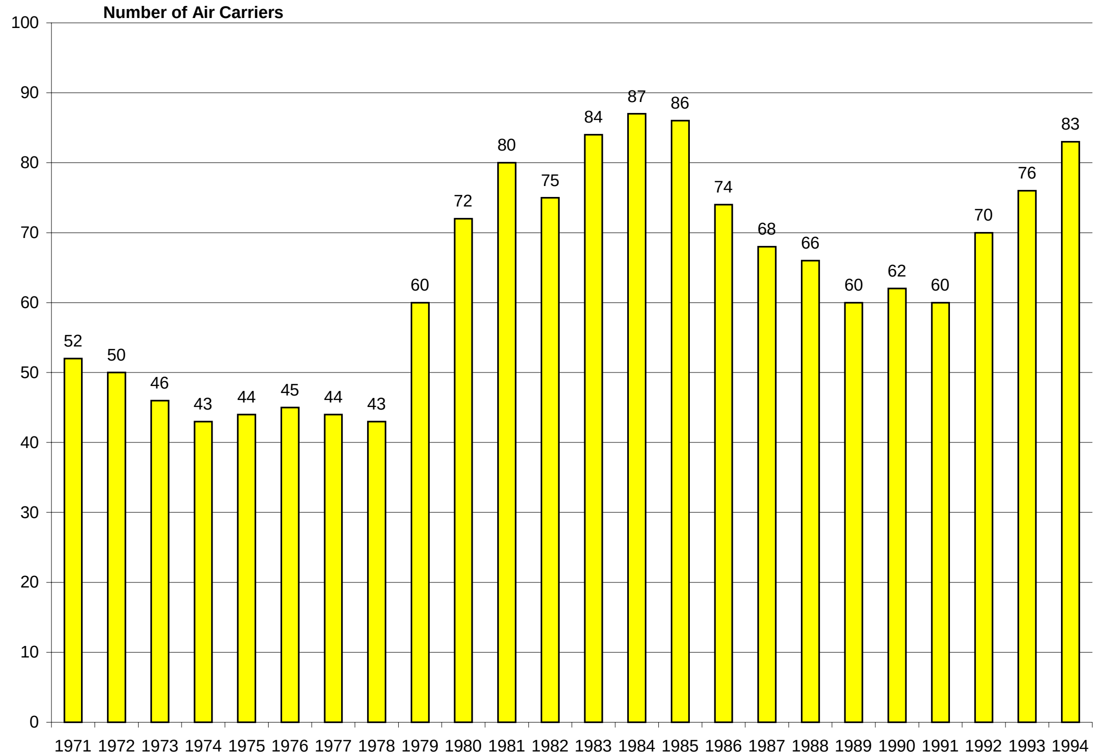


Source : "Schedule: T3 - Airport Activity Statistics", U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information
U.S. Department of Commerce, Bureau of Census

The Recent History of Air Passenger Travel

Since the advent of commercial jet aircraft, no change in the airline industry has impacted it as much as the Airline Deregulation Act of 1978. This legislation allowed any firm that met fitness requirements to enter or exit the air transport industry in any domestic market. In addition, prior to deregulation fares were regulated, but following the act the airlines were allowed to set fares and compete based on market conditions. The initial effect was the immediate increase in air carriers and a fare war that increased air passenger traffic. Figure 3, indicates the number of air carriers in the U.S. market submitting U.S. Dot Form 41 reports by year. The figure clearly shows an increase in air transport firms in the time following the legislation. Indeed, between 1978 and 1979 there was 40 percent increase in U.S. air carriers.

Figure 3
Air Carriers Submitting U.S. DOT Form 41 Reports



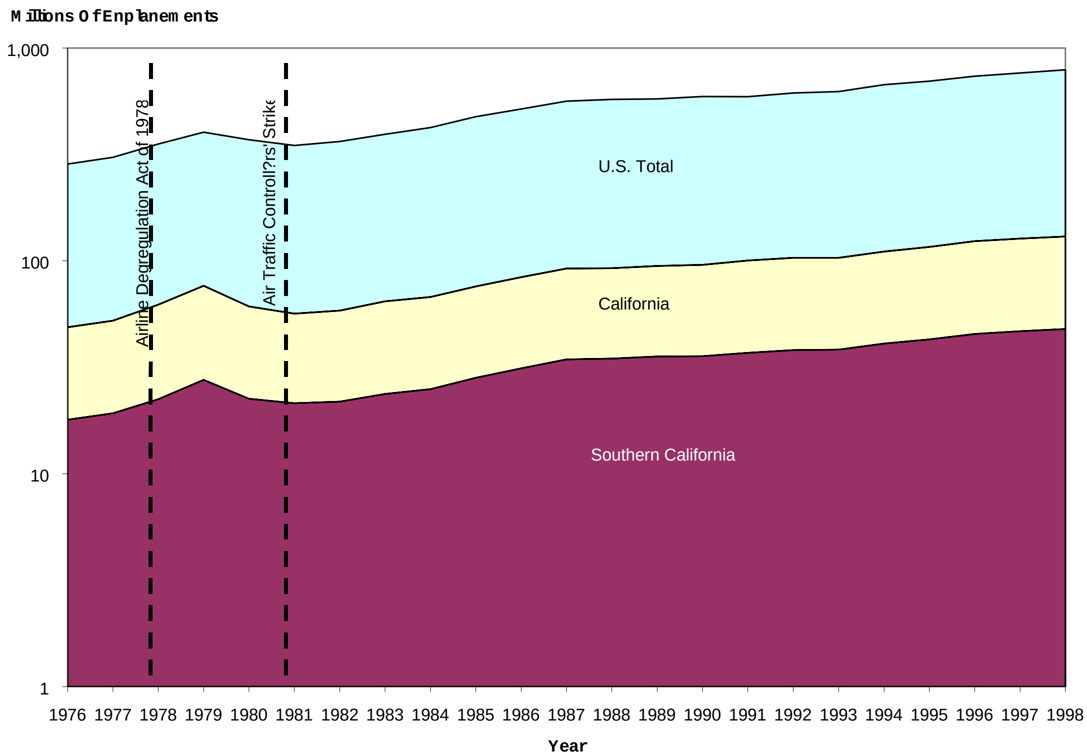
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information.

The deregulation of fares brought about a fare war as air carriers, both newly formed and older larger carriers introduced market strategies to conserve or increase market shares. The result of these fare decreases was a stimulation of demand. As indicated in Figure 4 the number of passenger enplanements increased dramatically in 1979 both in the U.S. as a whole and in Southern California specifically. However the increases were moderated in an anemic economy of 1980 as enplanements fell to just above 1978 levels and continued to drop in 1981 when the air traffic controllers' strike disrupted the market during an already weak economy. The end result was a decentralization of the airline industry as the market share of total traffic accounted for by the largest air carriers decreased from 94 percent in 1978 to 77 percent in 1985[1].

As airfares decreased the airlines responded by increasing efficiency and changing their route structures to lower costs. The results were a change from a linear point-to-point network to a hub-and-spoke network. This of course, allowed airlines to service many points without having all points directly interconnected. In addition, airlines developed innovative marketing strategies including frequent flyer programs, sophisticated discounting practices, and close operating agreements with smaller carriers and commuters to service lower demand routes while maintaining market control.

Figure 4

Number of Passenger Enplanements



* Note: A logarithmic scale is used to more readily compare Southern California, and California as a whole with the U.S. Total.
Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information and Federal Aviation Administration, Aviation Policy and Plans Office.

Once the market disruptions of deregulation and labor difficulties were totally absorbed into the system, the air passenger industry settled into a steady growth pattern similar to that witnessed prior to 1978. Table 3 presents the annual percent change in passenger enplanements.

[1] Bureau of Transportation Statistics, Transportation Statistics Annual Report 1996, "Appendix A: An Overview of the U.S. Commercial Airline Industry", p 236

Table 3
Annual Percent Change In Air Passenger Enplanements

Year	Southern California	California	US Total
1976	NA	NA	NA
1977	7.3%	7.1%	7.4%
1978	16.4%	20.7%	14.9%
1979	23.3%	22.0%	11.7%
1980	-18.6%	-20.9%	-5.0%
1981	-4.7%	-8.9%	-5.8%
1982	1.9%	4.1%	4.6%
1983	8.7%	11.5%	7.7%
1984	5.3%	4.7%	8.3%
1985	13.2%	11.5%	12.3%
1986	10.6%	10.5%	8.4%
1987	10.1%	9.5%	8.6%
1988	1.0%	0.3%	2.5%
1989	2.2%	2.3%	-0.1%
1990	0.4%	1.6%	3.0%
1991	3.5%	5.5%	-1.2%
1992	3.2%	3.1%	4.4%
1993	0.5%	-0.1%	1.8%
1994	6.8%	6.6%	8.0%
1995	4.5%	5.7%	3.5%
1996	6.1%	6.6%	5.4%
1997	2.9%	2.7%	3.5%
1998	2.5%	2.1%	3.9%
Passenger Enplanement Growth Summaries			
1976-1980	125.3%	124.9%	131.0%
Average Annual	8.5%	8.4%	8.7%
1980-1990	58.6%	55.7%	59.9%
Average Annual	4.7%	4.5%	4.8%
1990-1998	34.1%	36.9%	33.1%
Average Annual	3.7%	4.0%	3.6%
1976-1998	166.6%	166.0%	178.7%
Average Annual	4.6%	4.5%	4.8%
Population and Employment (Avg. Annual Growth)			
Population 1976-1998	2.0%	1.9%	1.0%
Employment 1976-1998	2.3%	2.5%	2.2%

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information and Federal Aviation Administration, Aviation Policy and Plans Office.

Since 1976, the average annual compounded rate of growth in enplanements has been 4.8 percent for the U.S. compared to 4.5 percent for California and 4.6 percent for Southern California. As a way of comparison, employment grew at an annual rate of 2.3 percent in Southern California, 2.5 percent in California as a whole, and at 2.2 percent for the U.S. during this same period. Population grew at a annual rate of 2.0 percent in Southern California, 1.9 percent in California, and 1.0 percent in the U.S. from 1976 to 1998.

From this comparison, it is evident that air passenger service in Southern California has grown faster than the population or employment, however, not as fast as was experienced by the rest of the country, even though employment and population increased at a faster rate in the local region. However, it is interesting that in recent years (1990-1998), air passenger enplanements in Southern California and California have outpaced the nation. In general, air passenger service has increased faster than the economy as measured by the Gross Domestic Product, which has expanded at an inflation-adjusted annual growth rate of 3.1 percent since 1977.

Recent History Of Air Freight Transport

Although air transportation of freight makes up a small proportion of the total shipments of goods, it makes a significant contribution to the flow of commodities in the U.S. Air transport has been the traditional method of transporting high value, time critical goods. As the U.S. economy changed from material-intensive to knowledge-intensive, and with the advent of overnight air delivery using the hub-and-spoke method of implementing delivery routes, the importance of airfreight operations increased dramatically. This change continued in the 1990s. Table 4 summarizes selected results of the 1993 and 1997 Commodity Flow Surveys as they pertain to airfreight.

Nationally the value of goods shipped by air increased by 53 percent between 1993 and 1997, compared to 30 percent for the total of all cargo modes. Nearly 3 percent of the value of all goods shipped in the U.S. are transported by air. This percentage is higher in California where in 1993 nearly 5 percent of goods shipped from California went by air (1997 figures are not currently available). There was an even more dramatic increase in the tonnage shipped by air during the period. Between 1993 and 1997 total tonnage shipped by air increased 61 percent compared to only 19 percent for all modes. However, airfreight shipments represent less than one tenth of one percent of all tonnage shipped.

Table 4

U.S. AIR FREIGHT COMPARED TO ALL MODES OF SHIPPING (1993 and 1997)

	1993	1997	Percent Change
Value of Shipments ($millions)			
All Modes	$ 5,846,334	$ 7,623,623	30.4%
Air Transportation	$ 139,086	$ 213,405	53.4%
Air Percent of All Modes	2.4%	2.8%	17.7%
Tons of Shipments (000s)			
All Modes	9,688,493	11,562,916	19.3%
Air Transportation	3,139	5,047	60.8%
Air Percent of All Modes	< 0 .1%	< 0 .1%	
Value Per Ton			
All Modes	$ 603	$ 659	9.3%
Air Transportation	$ 44,309	$ 42,284	-4.6%

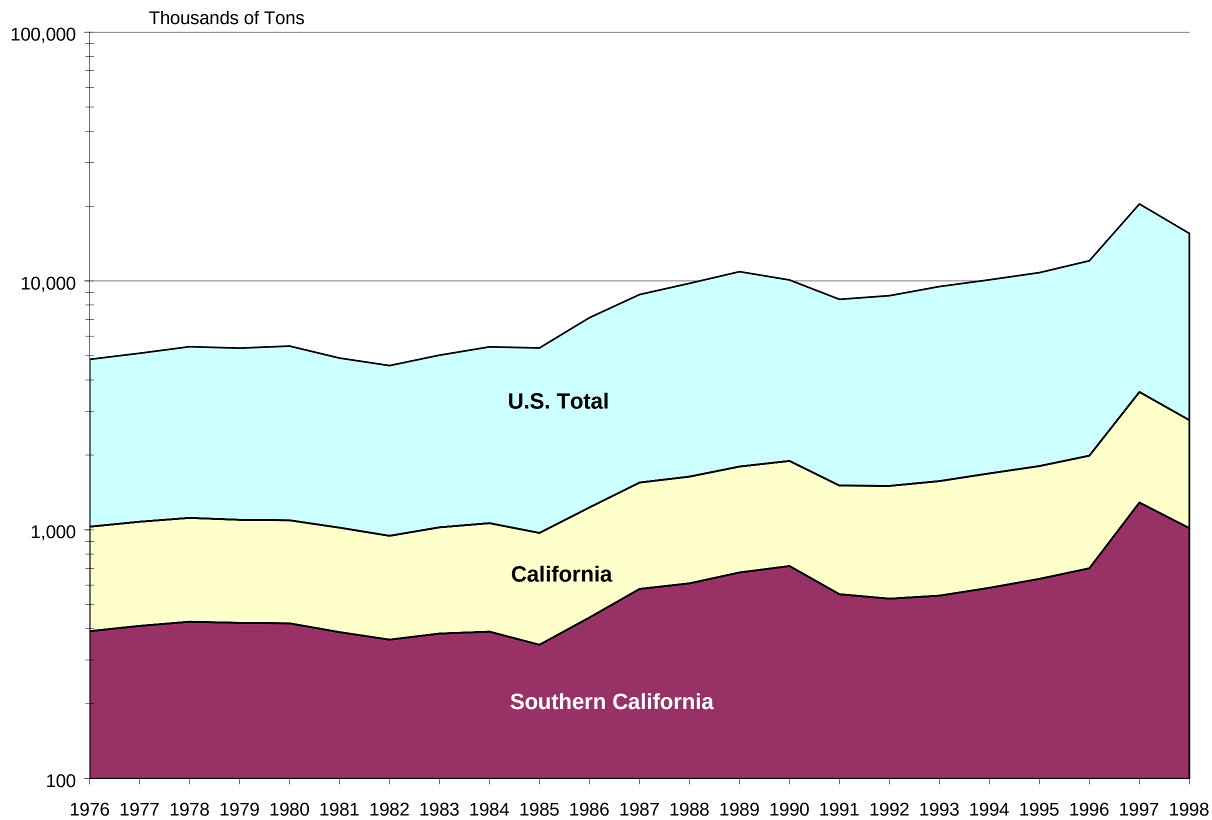
Source: "1997 Commodity Flow Survey", U.S. Department of Commerce, Economics and Statistics Administration, Bureau Of The Census and U.S. Department of Transportation, Bureau Of Transportation Statistics.

The average value per ton of goods shipped by air decreased from 1993 by nearly 5 percent while it increased for all other modes by 9 percent. This would indicate that it has become economically feasible to ship lower value goods by air. However it is still primarily a method for shipping high value commodities as the average ton shipped is valued at over $ 42,000 per ton compared to $659 per ton for all modes.

Comparing Southern California with the rest of the United States, similar patterns of growth and declines are indicated. Figure 5 presents a time series of cargo shipped from Southern California , California and the United States as a whole. In general, with a few exceptions, cargo enplanements tonnage in Southern California has increased in lockstep with nation as a whole. The general trend upward in tonnage appears to have only been disrupted by economic recessions of the early 80's and 90's. Table 5 presents the annual percent change in tonnage of freight enplanements.

Figure5

U.S. FREIGHT AND MAIL ENPLANEMENTS*



* Note: A logarithmic scale is used to more readily compare Southern California, and California as a whole with the U.S. Total.

Source: "Schedule: T3 - Airport Activity Statistics", U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information

Since 1976, freight tonnage enplaned grew at a annual rate of 5.7 percent for the U.S. compared to 4.7 percent for California and 4.4 percent for Southern California. As stated previously in this report, this is contrary to what was indicated by other statistical indicators, such as employment and population, which rose faster for Southern California and California then the rest of the Nation.

Table 5

ANNUAL PERCENT CHANGE IN TONNAGE OF FREIGHT ENPLANEMENTS

Year	Southern California	California	US Total
1976	NA	NA	NA
1977	4.8%	4.7%	6.3%
1978	3.9%	3.4%	6.9%
1979	-1.0%	-2.2%	-1.3%
1980	-0.4%	-0.7%	2.7%
1981	-7.7%	-5.9%	-11.5%
1982	-6.9%	-7.5%	-6.5%
1983	5.9%	9.8%	10.5%
1984	1.8%	5.0%	9.1%
1985	-11.5%	-7.1%	0.7%
1986	28.6%	25.4%	33.7%
1987	30.5%	23.3%	23.5%
1988	5.1%	6.1%	12.0%
1989	10.8%	9.2%	11.6%
1990	6.0%	4.9%	-9.9%
1991	-22.9%	-19.0%	-15.5%
1992	-4.1%	2.2%	4.3%
1993	2.8%	5.6%	9.6%
1994	7.7%	7.1%	6.4%
1995	8.5%	6.0%	6.9%
1996	10.2%	10.4%	11.9%
1997	22.5%	17.8%	13.4%
1998	18.3%	15.1%	11.8%
Overall Growth 1976-1998	159.0%	173.8%	235.6%
Average Annual 1977-1998	4.4%	4.7%	5.7%
Population 1976-1998	2.0%	1.9%	1.0%
Employment 1976-1998	2.3%	2.5%	2.2%

Source: "Schedule: T3 - Airport Activity Statistics", U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information

AIR TRANSPORTATON FORECASTS

U.S. Government Forecast Of Air Passenger Volume

The U.S. Department of Transportation has prepared forecasts of U.S. air passenger volumes through 2015. These forecasts can be compared to some extent with the 2020 SCAG region forecasts that will be the subject of this economic impact analysis.

Table 6

U.S.D.O.T. FORECAST OF AIR PASSENGER ENPLANEMENTS

Year	Southern California	California	U.S. Total
1998	47.8	82.2	659.7
1999	49.4	84.9	684.7
2000	51.0	87.7	709.9
2001	53.0	91.2	737.4
2002	55.1	94.9	765.8
2003	57.3	98.7	795.0
2004	59.6	102.7	825.1
2005	62.0	106.9	856.2
2006	64.4	111.0	886.8
2007	67.0	115.4	918.3
2008	69.6	119.9	950.9
2009	72.4	124.6	984.4
2010	75.2	129.4	1,019.0
2011	77.7	133.8	1,050.7
2012	80.4	138.2	1,083.3
2013	83.1	142.9	1,116.7
2014	85.9	147.7	1,150.9
2015	88.8	152.6	1,186.1
Percent Change 1998-2015	85.8%	85.6%	79.8%
Avg. Ann. % Chg. 1998-2015	3.7%	3.7%	3.5%

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information and Federal Aviation Administration, Aviation Policy and Plans Office.

The forecasted annual growth rate for air passenger enplanements through the year 2015 is about 25 percent slower than the average annual air passenger growth experienced over the last 22 years. In Table 4 the average annual rate of growth for the U.S., California, and Southern California was about 4.5 percent per year for the period of 1977 to 1998. The projected annual growth rate in air passenger volumes for the 17-year period of 1998 though 2015 is about 3.5 percent. However, it should be noted that while the annual growth rate for the U.S. was a little faster than California and Southern California in the last 22 year period, the Nation is expected to grow at a little slower rate than the State or the local region over the next 17 years.

SCAG 2020 Regional Transportation Plan Forecasts

The Southern California Association of Governments has prepared a 2020 regional transportation plan baseline forecast (RTP Medium) and several alternative forecasts of air passenger and air cargo volume for the year 2020. The RTP Medium and four alternative forecasts scenarios (scenarios 2C-HSR, 8, 9, and 6) are the focus of the economic impact analysis of this study.

Table 7

2020 RTP AIR PASSENGER FORECASTS

Year / Forecast Scenario	Air Passengers (000s)	Percent Change	Avg. Annual Growth Rate
Base Year:			
1998	81,850	--	--
2020 Forecast Scenario:			
RTP Medium	157,410	92.3%	3.0%
2C-HSR	156,089	90.7%	3.0%
Scenario 8	156,469	91.2%	3.0%
Scenario 9	154,819	89.1%	2.9%
Scenario 6	140,850	72.1%	2.5%

Source: Southern Cailfornia Assocation of Governments.

The SCAG RTP medium projection for annual growth in air passenger volumes during the 22-year forecast period is about 3.0 percent per year. This annual rate of growth is about 19 percent slower than the U.S.D.O.T. forecast of 3.7 percent per year for Southern California and would result in about 24.6 million fewer annual passengers by the year 2020. It should be noted that the U.S.D.O.T. forecast was only through the year 2015 and was reporting a slowing rate of growth (*e.g.*, 3.37% annual growth rate for 2014 to 2015). However, the SCAG forecast is still much more conservative than the U.S.D.O.T. forecast.

Table 8

2020 RTP AIR CARGO FORECASTS

Year / Forecast Scenario	Air Cargo (tons)	Percent Change (1998-2020)	Avg. Annual Growth Rate (1998-2020)
Base Year:			
1998	2,605,559	--	--
2020 Forecast Scenario:			
RTP Medium	8,900,277	241.6%	5.7%
2C-HSR	8,900,877	241.6%	5.7%
Scenario 8	8,900,899	241.6%	5.7%
Scenario 9	8,900,900	241.6%	5.7%
Scenario 6	N/A	N/A	N/A

Source: Southern Cailfornia Assocation of Governments.

The SCAG RTP medium projection for annual growth in tonnage of air cargo shipments during the 22-year forecast period is about 5.7 percent per year. There is no statistical difference between the five SCAG 2020 cargo forecast scenarios, except that no forecast is presented with the Scenario 6 air passenger forecast. The 5.7 percent annual rate of growth in tonnage of air shipments results in a 242 percent increase in total cargo weight. The 8.9 million tons of shipments forecast for the year 2020 is 6.3 million tons more than the 2.6 million shipped in 1998.

Private Sector Aviation Forecasts. The Airports Council International (ACI) forecast of air passengers and air cargo growth was released in September 1998 for the period of 1998 to 2010. The ACI forecast for air cargo indicates 6.4% average annual growth in traffic worldwide. ACI's forecasts of passenger traffic for the U.S. is just under 3% annual growth and 4.7% worldwide. The Boeing forecast of air cargo, released in June 1999, reports world air freight will grow 6.4% annually through 2018 and the greatest air freight regional market growth will occur for intra-Asian routes which will average 8.2% annual growth. The Airbus report, published in

June 1999, forecasts worldwide growth in air passenger traffic at an average annual rate of 5.0 percent, while cargo traffic growth will average 5.9 percent per year.

Forecasts of air cargo shipments are more difficult to predict, however, there are several factors related to business information systems and changes in technology that may have a substantial impact on the demand for shipment of air cargo. The following section discusses some of these potential impacts.

E-COMMERCE AND THE AVIATION INDUSTRY

Rapidly changing e-commerce technologies will have a substantial impact on the long-term trend in air transportation demand. Measuring current impacts and forecasting are difficult because the Internet and the “dot-com” business model is a revolution that is currently in process. As new and existing businesses rush to fulfill the needs of their customers in cyberspace, the historical distribution systems of “bricks and mortar” retail stores has been turned upside down. Even more importantly however, is the electronic interconnection of the global chain of suppliers, manufacturers, distributors, retailers, and consumers, resulting in greater productivity with smaller just in time (JIT) inventory deliveries for both manufacturers and retailers.

Business To Consumer E-Commerce

In a global market where the lowest cost supplier wins, the higher cost of air transportation is a penalty to be avoided unless the increased delivery speed sufficiently reduces other costs such as product inventory. As a general rule of thumb, air cargo shipments are twice as expensive as surface transportation. In the early build-up phase of e-retail, many dot-com companies are willing to provide overnight delivery at no extra charge while losing money on every sale in order to build sales volume and market share.

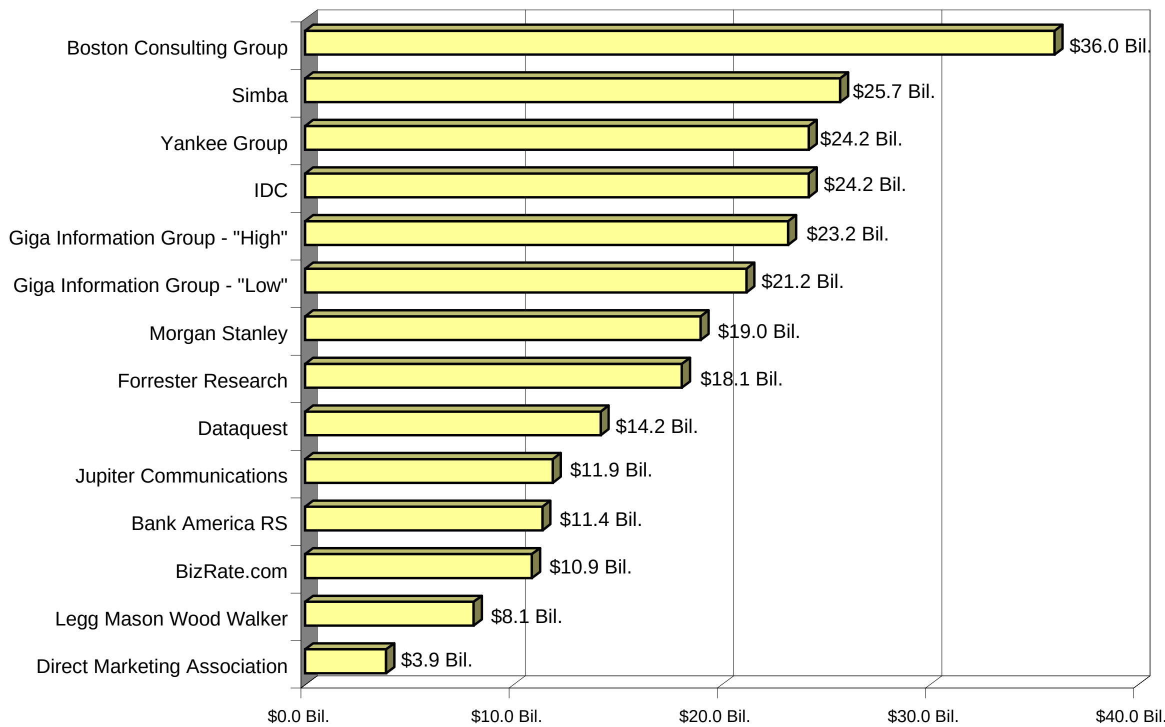
However, the next phase of e-retail has started for some of the dot-com companies. Some of these companies have determined that operating without a physical presence lacks some efficiency and doesn’t completely serve their customers’ needs. They have determined that they need to combine “clicks and mortar” to reduce overall costs and to increase overall customer satisfaction with the fulfillment process. Amazon.com will spend $300 million to purchase and build 3.0 million square feet of warehouse space during the next year. Federated department Stores, Inc. acquired catalog operator Fingerhut Cos. for $1.7 billion. Fingerhut’s warehouses are also used for inventory and distribution for companies such as Wal-Mart Stores, Inc. and e-Toys, Inc. Webvan Group, Inc., is planning to spend $1 billion to build 27 distribution centers in the U.S.[5] As a result of establishing more traditional regional and metro-area warehousing distribution channels, proportionately less air cargo delivery costs will be required for each dollar of Internet retail sales.

Currently it is difficult to measure the amount of Internet e-commerce business to consumer sales (B2C). This also makes it difficult to forecast this dynamic revolution in business operations. For example, in September 1999 an e-Marketer report compiled estimates of 1999 total consumer online shopping revenues from 13 different market research companies. The estimates of total 1999 sales ranged from a high of $36 billion (Boston Consulting Group) to a low of $3.9 billion (Direct Marketing Association). Other notable estimates were $24.2 billion (Yankee Group), $18.1 billion (Forrester Research), and $11.9 billion (Jupiter Communications).[6]

The report highlights the current difficulty in measuring e-commerce. Although sales are growing rapidly, the study also indicates that e-commerce represents about one percent of the $2.3 trillion U.S. retail sales in 1999. However, all these studies include services such as transportation (e.g., airline tickets) and financial services in their estimates of B2C e-commerce. The more appropriate measure would be total e-commerce as a percent of total personal consumption which is estimated at $2,315 Billion in 1999, which equals less than one half of one percent.

[5] Wall Street Journal, “E-Commerce: Getting the Goods”, November 22, 1999, pg. R39.
[6] The e-Marketer, “e-RetailReport”, September 1999, <www.emarketer.com>.

Figure 6
Estimated 1999 Consumer Online Shopping Revenues



Potential E-Commerce Market Penetration. Some products and services will continue to be fairly resistant to remote e-commerce purchase of the good or service without the consumer's physical presence or inspection of the item or service at the point of sale. For example, eating and drinking purchases, grocery purchases (Webvan.com not withstanding) gasoline purchases, auto and home repairs, real estate, and many personal services. Clothing purchases, jewelry, art, furniture, autos (new and used), and even many household appliances are somewhat resistant to remote purchase because of the consumer's desire to inspect (e.g., see, touch, hear, and even smell) the product.[7] Furthermore, for some consumers there is a recreational and social aspect of shopping that is not fulfilled by the Internet. Therefore, most industry analysts are expecting far slower growth and market penetration of consumer e-commerce than business to business e-commerce, at least in sectors that are already well served by brick and mortar.

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[7] Lisa M. Grobar, Ph.D., "Regional Economic Forecast, 1999-2004", November 17, 1999.

Global Market Place. The emerging global supply chain information systems and e-commerce are stimulating strong growth in air shipments. Some package delivery services like UPS and the U.S. Postal Service are currently experiencing rapid growth in delivery volume to fulfill e-commerce purchases. FedEx, the pioneer in overnight document delivery, has a smaller focus on residential delivery, and has experienced slower sales growth due to the introduction of sophisticated supply chain management systems and e-mail delivery of business documents. The Wall Street Journal reported that during the last 25 years FedEx has filled a need when businesses required fast delivery of relatively small and lightweight components, key production parts or had to make up for lost time in delivering products or documents. This need for speed was often driven by business decisions that were made with inaccurate and/or out-of-date information on inventories, production schedules, and sales.[8]

Electronic Document Delivery and Bill Presentation. There is a strong push for electronic bill presentation and payment. On average, it costs the billing company approximately $1.25 to send a paper invoice statement and about $1 to process the invoice payment. In contrast e-billing and electronic payment processing averages about $0.50 and $0.10, respectively per transaction. Nearly 25 percent of all postal service revenues are currently derived from delivery of hard-copy bill statements and the return delivery of payments.[9]

The U.S. Postal Service delivered 201.6 billion pieces of mail in 1999 (+2.3%). However, Robert Krause, vice president of electronic commerce at the USPS, is forecasting a decline in physical document delivery by 2005. This will occur as a result of electronic document delivery, electronic courier services (encrypted and certified document delivery), and electronic bill presentation resulting in a 3 percent annual decline in USPS mail volume.[10,11]

Business To Business E-Commerce

Business to business (B2B) sales over the Internet have experienced rapid growth and acceptance across a wide spectrum of industries. Total B2B sales in 1999 are estimated at about $100 billion, about a three-fold increase from 1998. The B2B sales are easily adapted from more traditional phone or fax orders for business supplies, parts, and materials. Both the selling company and the purchasing company are better served at lower transaction costs through the online sales. The Boston Consulting Group has forecasted B2B e-commerce sales

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[8] The Wall Street Journal, "Overnight, Everything Changed for FedEx; Can It Reinvent Itself?", November 4, 1999.
[9] Randy Barrett, "E-Mail Address Unknown", Inter@ctive Week, October 11, 1999.
[10] Randolph Schmid, "Postal Service Marks Fifth Straight Profit-Making Year", Associated Press, December 9, 1999.
[11] Randy Barrett, Op Cit.

to continue to expand at 300% per year from 1998 through 2003, reaching $2.8 trillion and will represent about 25% of total U.S. B2B industry sales.[12]

The B2B electronic Internet transaction replaces the traditional sales order process, but this does not usually change the traditional distribution channels for shipment and delivery of the business products and materials. However, other related digital information forces are driving substantial changes in traditional distribution channels.

Supply Chain Management Systems. A fully integrated, global supply chain management system, goes beyond an intranet that digitally links a single business' operations and administrative functions. The supply chain requirements for information are now end-to-end, incorporating detailed current inventory, production capacity, and delivery information from many suppliers' operations as well as customers' operations for business to business sales and/or anticipating product demands of the retail consumer. The introduction of these very sophisticated, vertically integrated, supply chain management systems are yielding higher productivity and substantially reduced costs for businesses, including faster product design, lower cost suppliers, internet based product testing, faster overall production, efficient inventory management, and faster fulfillment.[13,14]

Just In Time Delivery. In order to reduce the costs of carrying inventories, many supply contracts are now written with guarantees for just in time deliveries. For some suppliers there is no alternative to air transport of their products in order to meet the trend toward shorter periods between the purchase order and physical delivery. This is especially true for products with very short life cycles such as some electronic components and computer chips, but is also true for fashion apparel and higher value perishable items. The air cargo industry is benefiting from the surge in electronic commerce as businesses increasingly turn to Internet-based ordering, shipping and tracking options and drive up the demand for just-in-time delivery solutions. As a result, UPS Chairman, James Kelly, reports that his company estimates that U.S. inventories will be reduced by $500 billion (about 50%) over the next five years.[15]

JIT manufacturing processes across a broad spectrum of industries are creating greater pressure on independent parts and sub-assembly suppliers to either locate operations nearer their largest customers (the Mother plant) or to secure rapid, dependable distribution channels. This is exactly what has been occurring in Mexico with the maquiladora plant operations. For

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[12] Mel Duvall, "B2B E-Commerce To Skyrocket," Interactive Week, December 22, 1999.
[13] Internet World, "Web-Enabled Enterprise: Cisco's Billion Dollar Plan", October 1, 1999, pg 70.
[14] Internet World, "The Supply Chain, Simplified Via the Web", October 15, 1999, pg 57.
[15] Barbara Cook, "E-Commerce: Air Cargo Goes High Tech", Airport Magazine, June 1999.

example, Sanyo's large television manufacturing facility in Tijuana, Mexico receives approximately 32,000 pounds of international air shipments through LAX with transshipment by truck each working day. However, by January 1, 2001 nearly all non-NAFTA country suppliers to Sanyo's Tijuana operation will be located in Mexico. Effectively, removing nearly 5,000 tons of annual air shipments that currently transit through the LAX port of entry.[16]

E-Commerce And Air Cargo Forecast. Both the Boeing and Airbus 20-year forecasts for air cargo and air passenger volumes incorporate impact assumptions for the changing global supply chain and forecasts of worldwide GDP. Their combined forecasts indicate that U.S. air cargo tonnage will increase about 215%, while air passenger volume will increase by 80%. Total worldwide air cargo will increase 245% and Asia will lead all world regions with an estimated increase of 380% for the period. A recent air cargo study by Mohamed Zairi of the University of Bradford Management Centre, UK specifically addresses shorter product lifecycles and global supply chain management systems. Professor Zairi has forecasted a somewhat higher 20-year growth increase of 266% for air cargo worldwide (6.7% annual average). In addition Zairi's growth forecast for the Asian region is 460% (9.0% annual average growth).[17]

Southern California's major international ports (i.e., LAX, San Pedro, and Long Beach) are important gateways for import and export trade with the Asian markets. The very strong growth forecasts for Asian-region air cargo, indicate that Southern California should benefit from the existing strong Asian international trade flow. It is likely therefore, that growth in international air cargo volumes will exceed worldwide average growth rates listed above. Therefore, the current 20-year air cargo growth forecast of 242% (2.6 million tons rising to 8.9 million tons) for the SCAG region is probably conservative. With unconstrained air service, the 242% growth forecast for air cargo is probably the low-end for the SCAG region, with increases in the mid to high-end range of 265% to 285% (6.7% - 7.0% annual average growth) over the next 20 years.

The forecasts for continued rapid development of the Asian economies and the dynamics of a global marketplace and global supply chains will require constant monitoring and reevaluation of air cargo and air passenger growth trends.

[16] CIC Research, Inc., "Survey of San Diego and Baja California Shippers and Freight Forwarders", May 1999.
[17] Mohamed Zairi, "Benchmarking in the Air-Freight Industry", International Journal of Physical Distribution & Logistics Management, Vol. 29, No. 5, 1999.

ECONOMIC IMPACT STUDY METHODOLOGY

STATEMENT OF THE PROBLEM

There have been many studies that focused on individual parts of the SCAG region's aviation industry. Several studies have also been undertaken on the potential for conversion of one of the region's military airports to commercial use. (e.g., El Toro, March, Norton, etc.)[18] These studies have two things in common. First, they highlight the congestion in the most heavily used airports, and the need for expansion of airport facilities to meet the region's growing demand for air transportation services. Second, they assess the economic benefits associated with the project they have under review.

With every potential aviation project supplying services that would otherwise be supplied somewhere else in the region, the Southern California Association of Governments (SCAG) has decided there is a need to look at the region's air transportation services as a whole. SCAG's objective was to estimate the future (year 2020) region-wide demand for aviation services without any constraints at any airport (i.e. a 2020 baseline). This future unconstrained baseline and the resulting economic benefits would compare alternative airport and infrastructure development scenarios that introduce constraints and inducements to reshape the future aviation industry in the region. In this way, comparisons can be drawn which show the differential economic impacts, and their distribution within the region.

STUDY METHODOLOGY OBJECTIVES

This study has a number of objectives including assessing the economic impact of the aviation industry on the SCAG region in the year 2020, and how certain proposed though as yet hypothetical changes in the region's airport system will change the economic impacts. The study also examines other economic characteristics of the region in terms of how they would affect the future regional economy and air transportation's role in it. The additional study objectives include assessments of:

∉# Custom district exports and imports with estimates of local content.
∉# The region's service industries exports and imports.
∉# The manner in which e-commerce will impact the movement of goods and people and whether the current air cargo forecast captures the growth impact from e-commerce.
∉# Comparisons of aviation's transportation services with other transportation modes.
∉# Transshipments of domestic products and analysis of product origin and destination.

These elements are discussed in the report and analyzed more thoroughly in the Appendices.

Methodological Approach

Many economic studies have been conducted on the aviation industry of specific regions and have included many and varied concepts of the economic role of the industry. Most studies go beyond a simple cost benefit analysis of whether the airport project will generate sufficient revenues to cover the capital and operating costs yet fall short of a complete cost benefit study going into external costs and benefits. Studies that have attempted to quantify external costs such as noise, and other environmental pollution, as well as social benefits of aviation have been criticized for being too ambitious relative to the data.[19] For example, studies have attempted to quantify the reduction in the market value of residential housing attributable to airport noise.[20] At the same time, ***increases*** in commercial land values around airports is said to be attributable to the "catalytic" benefits of proximity to air transportation.[21]

Focus On Benefits. It is more common to find studies that limit economic analysis to only the benefits side of the equation. A thorough list of the economic benefits of air transportation is presented by the Air Transport Action Group (ATAG) in an article which reviews global performance, growth, and local impacts defined as the direct, indirect and induced impacts.[22] The article goes further to describe certain "catalytic" economic benefits of air transportation. Such benefits are attributable to "new and faster means for distributing goods

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[18] op cit. See also, Erie, Steven P. et al, "A New Orange County Airport at El Toro: An Economic Benefits Study," 1998.
[19] Howard, George P., "The Airport Environment: Economic Impact on the Community," 1974, Airport Economic Planning. Pgs.569-582, 1974.
[20] Uyeno, Dean & Stanley W. Hamilton & Andrew J.G. Biggs, "Density of Residential Land Use and the Impact of Airport Noise, "Journal of Transport Economics and Policy, pg. 3-18, 1993. See also Collins, Alan & Alec Evans, "Aircraft Noise and Residential Property Values: An Artificial Neural Network Approach," Journal of Transport Economics and Policy, pgs. 175-197, 1994.
[21] Erie, Steven P., John Kasarda, & Andrew McKenzie, "A New Orange County Airport at El Toro: an Economic Benefits Study, 1998.
[22] ATAG, The Economic Benefits of Air Transport (1994).

and services throughout the world", resulting in "increased economic efficiency" which results in lowered cost of trade and wider markets for existing industries, and whole new industries made possible by air transportation.

Many studies have included variations on "catalytic" economic impacts, which could be interpreted as external (or social) benefits. The idea of catalytic impact is very much like the notion that forward linkages in economic input-output models are a better guide to a sector's potential for generating economic development than are the backward linkages typically used in economic impact studies.[23] That is, the sales of air transportation services to other sectors of the economy are a more important indicator of the role of air transportation in the economic growth of a region, than are the purchases by air transportation providers from the rest of the economy. However, it is the latter on which airport economic impact studies are based.

The Chicken Or The Egg. Other studies have questioned whether airports generate economic growth. Rather they argue that the growth in air transportation services is in response to the general growth in the region.[24] This chicken or egg controversy, however, could be bypassed by using an economic growth conceptualization that treats air transportation in the context of economic or industry "clusters." The idea here is that aviation may be part of a variety of industry clusters, which taken together, provide critical inputs to growing segments of the economy.

Industry Cluster Analysis. For example, this type of analysis would put aviation, along with recreation, entertainment and attractions, hotels, convention centers, etc., in a "tourism cluster" of economic activity that comprises a significant part of the Southern California economy. It is also suggested that in combination with a number of high tech industries, aviation may form an industry cluster with just-in-time (JIT) manufacturing as well as e-commerce. These are economic clusters that together provide for significant growth in the region's future economic base.[25] The critical characteristic of air transportation in this case is the sector's ability to quickly move air cargo throughout the world. Although the main focus of this study is on the economic and fiscal impacts of the Southern California aviation industry, certain aspects of a broader analysis of economic benefits will be introduced with the additional objectives outlined in the Introduction.

Studies have also gone into the "costs" associated with **not** expanding an airport or adding new airports. This goes beyond the concept of "opportunity cost" or "benefits foregone"

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[23] Hoover, Edgar M., An Introduction to Regional Economics, New York, Alfred A. Knopf, p. 290, 1971.
[24] de Neufville, Richard, "The Bottom Line," 145-167 in Richard de Neufville, Airport Systems Planning, 1976.

by quantifying congestion costs and associated deterioration of competitive position relative to less congested airports.[26] This along with the length of time it takes to develop new airports is cited as a primary reason for moving ahead on new airport initiatives well in advance of the demand for new services. The main focus of this study avoids much of this type of analysis, as it is simply too difficult to quantify. However, this study does employ SCAG's forecasts of total regional air passenger and cargo volume, coupled with airport by airport allocation predictions from a Regional Airport Demand Allocation Model (RADAM) which may implicitly or explicitly include such difficult to measure elements.[27]

There are at least two I-O applications that have been used in the analysis of the economic impact of a region's air transportation facilities. One follows a more conventional application of input-output economic impact analysis defining direct and indirect impact as limited to current production of air transportation services. The other, follows the FAA guidelines and includes capital spending as part of direct impacts, and includes all capital and current spending associated with the demands placed on the regional economy by air passengers in the category "indirect impacts".[28] There are arguments for each of these approaches so rather than picking one over the other, this study will assess reasonable economic impact estimates both ways.

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26 Erie, Steven P., John Kasarda, & Andrew McKenzie, "A New Orange County Airport at El Toro: an Economic Benefits Study, 1998.

27 *Ibid* See Appendix A.

28 Other approaches have included air passenger spending in direct impacts, see for example State of California Airport Economic Impact Model, produced by Economic Research Associates under contract with the California Department of Transportation Division of Aeronautics, 1994.

SCAG REGION AVIATION INDUSTRY ECONOMIC IMPACTS

METHODOLOGY

In this study a conventional application of regional input-output (I-O) analysis is used to measure the economic impacts of aviation services within the SCAG region. The levels of air transportation services that are analyzed are based on four different 2020 regional transportation planning scenarios for aviation development. The assumptions and parameters of these development scenarios are explained in greater detail in the appendix.

Two methodological features of the I-O analysis are presented. The first is the derivation of input-output relationships in the region using data and software provided by the Minnesota Implan Group (MIG). This I-O modeling software and data is called IMPLAN and is available (for a fee) for every county in the United States. The most recent data at the onset of this study was 1996, but with price data and productivity data available from the U.S. Department of Labor, Bureau of Labor Statistics, CIC prepared I-O models for 1998 and 2020. Additional data for the 2020 model were derived from employment forecasts by county made or obtained by SCAG. All dollar amounts for the I-O analysis are stated in 1998 dollars.

Definitions

The application of I-O models to aviation impact analysis has been used in many prior studies. Indeed, the FAA has established impact analysis guidelines because of a range of quality and a lack of comparable standards among the various studies. Unfortunately, many aviation impact studies are still not comparable because of variation in approach based on different conventions for reporting results and different interpretations of the impact analysis guidelines provided by the FAA. A more thorough discussion of these differences is presented in Appendix A.

Differences in many of the publicly released studies relating to impacts (aside from air passengers and air cargo volume differences) were primarily related to which economic activities were included in the analysis and which were excluded. Further substantial differences are related to which convention is used to report the results of the economic impact study. The latter boils down to whether the income impacts (*i.e.*, wages, salaries, and proprietors earnings) are summed with the output impacts (*i.e.*, sales of all sectors including sales of labor and entrepreneurial effort) to arrive at an estimate of the total economic impact. In this study, output does not include income, but both output and income impacts are estimated and presented.[29]

Some airport impact studies have only included economic activities involved in the production of aviation services, while others have included anything and everything that uses air transportation services as well as anything and everything that the air transportation services producers use (refer to footnote 29 below). The following paragraphs describe four levels of economic impacts, with each additional level encompassing a larger sphere of economic activities that are less and less directly related to air transportation services.

Level-1 Impacts. In some studies, the I-O analysis limited the direct economic impacts to just those associated with the production of air transportation services. This is the most conservative level of impact analysis. This Level-1 Impact as defined in this study includes the direct effects (the revenue or output) of only those enterprises involved with the production of air transportation services. This includes all businesses that are engaged in furnishing domestic and/or foreign transportation by air and also those operating airports and flying fields and furnishing terminal services. These include all air transportation passenger services scheduled and unscheduled, air courier services, and air cargo services.

The indirect impacts of the I-O model are derived from the direct production of air transportation services and would include establishments that provide the fuel and many other inputs required by aircraft and airports. For example, many establishments provide inputs to airport operations, such as security, telecommunications, maintenance, power and other utility companies. The Level-1 Impact analysis also includes the induced impacts, which are the purchases made by the employees of the businesses that directly or indirectly produce the air transportation services. The resulting “direct”, “indirect”, and “induced” impacts of Level-1, represent the lowest level of impact assessment and are the most easily justified. Impact assessments beyond this level are less easily argued as attributable to aviation services.

Level-2 Impacts. Level-2 Impacts include the impacts described above in Level-1 and also include the impacts of non-resident air passengers. These are the direct, indirect and induced impacts of goods and services purchased by non-resident air passengers while they

[29] If this sounds like double counting the impact, it is because it is. CIC will save for another day the discussion of bigger numbers that beget ever-bigger numbers.

are in the SCAG region (*i.e.*, non-air transportation expenditures such as meals, lodging, ground transportation, shopping, and entertainment). This excludes air passengers that reside in the region and air passengers that are in-transit (*i.e.*, they do not leave the air transportation area and therefore, do not spend money in the region outside the airport).

At Level-2 there is an implied assumption that these non-resident air travelers would not have traveled to the SCAG region if air transportation services were not available. The purchases of non-residents (many of whom are leisure travelers to the SCAG region), are considered exported goods or services that are purchased by customers who live and work outside of the local economy.

Level-3 Impacts. A third level of economic impacts adds to the first and second levels those economic activities that use air cargo carriers to export their products. This assumes that exporters would not have been able to manufacture and ship their product by any other means including alternative airports outside of the SCAG region. We have provided an assessment of the activities that ship to foreign destinations, but we have assumed that air cargo shipments to domestic markets would find alternative transportation modes or routes.

Level-4 Impacts. A fourth level of economic impact analysis would include what is called in the literature "catalytic impacts." This includes activities that are attracted to airport locations, not because they provide inputs to the aviation services, but because proximity to air transportation gives them a competitive edge. It is very difficult to separate these effects from the first three levels of impact described above, and much of the discussion of catalytic impacts deals with the capital investment features of these activities in the vicinity of airports. Indeed, catalytic impacts were not estimated in this study because of the difficulty in separating such impacts and because this study does not assess construction or capital goods requirements in the future scenarios.[30]

[30] At SCAG's request, no capital goods transactions were included in this analysis. For example, all of the aviation related investments that would be made between the present and the year 2020 are excluded from the study. Obviously, given the SCAG region development options that are proposed for the next 20 years, capital investments could result in substantial and quite different economic impacts.

RTP 2020 MEDIUM SCENARIO: BASELINE 2020 RTP FORECAST

There were a total of 11 aviation forecast scenarios for the SCAG region in the year 2020. The RTP 2020 Medium scenario is the baseline planning forecast consisting of 157 MAP and 8.9 million tons of air cargo in the year 2020 assuming all of the regional airports are unconstrained. A total of five forecast alternatives were chosen for the analysis.

Level-1 Economic Impact Results: 2020 RTP Medium Scenario

At the first level of impact for the SCAG region 2020 RTP Medium Scenario, the air transportation services sector will generate total impacts (direct, indirect, and induced) of:

↓# $30.1 billion in total output (revenue)
↓# 191,100 jobs
↓# $12.2 billion income
↓# $1.3 billion tax revenue

(see Appendix G for detailed impacts)

Level-2 Total Economic Impacts

Based on the 2020 Medium RTP forecast scenario, the Level-1 air transportation services impacts are combined with the Level-2 impacts attributable to non-resident air passenger expenditures. The resulting total Level-Two Impacts (direct, indirect, and induced) are:

↓# $61.5 billion total output
↓# 539,600 jobs
↓# $23.1 billion income
↓# $3.9 billion tax revenue

Level-3 Total Economic Impacts

The same 2020 Medium RTP Scenario with the third level of economic impacts included increases the total economic impact estimates to:

↓# $98.2 billion total output
↓# 706,300 jobs
↓# $35.3 billion income
↓# $5.0 billion tax revenue

Level-3 economic impacts include the value of economic activities attributable to foreign exports of goods produced in the region. This assumes a large sphere of impacts whereby specific goods manufactured in the region would not find any alternative mode of transportation (including ground shipment to another out-of-region airport) and therefore would not be produced if they could not be exported from the local economy by air.[31]

SCENARIO 2C-HSR: 2020 RTP FORECAST ALTERNATIVE

Scenario 2C-HSR modifies the RTP 2020 medium scenario to answer the question: "What effect does high speed rail (HSR) have on Ontario and Inland Empire airports' ability to meet future demand?" This scenario assumes HSR linking the Inland Empire (March and/or Ontario airports) to LAX. It also assumes constrained Burbank (9.7 MAP) El Toro (28.8 MAP) and LAX (70 MAP and 2 million tons cargo) and legally constrained Long Beach (3.0 MAP). John Wayne, March, Ontario, Palm Springs, Palmdale, Pt Mugu, San Bernardino International, and Southern California Logistics airports are assumed unconstrained (see Appendix G for detailed impacts).

Level 1 Total Economic Impacts: Scenario 2C HSR

The level-1 total economic impacts based on the 2020 forecast Scenario 2C HSR will generate direct, indirect, and induced impacts of:

↓# $29.8 billion output
↓# 189,500 jobs
↓# $12.1 billion income
↓# $1.3 billion tax revenue

Level-2 Total Economic Impacts: Scenario 2C HSR

The Level-2 economic impacts based on the 2020 forecast Scenario 2C HSR are estimated at:

↓# $60.3 billion total output
↓# 528,300 jobs
↓# $22.7 billion income
↓# $3.8 billion tax revenue

[31] This of course leaves out impacts attributable to capital transactions, as for example the construction of new airports. It also excludes so-called "catalytic impacts."

Level-3 Total Economic Impacts: Scenario 2C HSR

Level-3 total economic impacts based on the 2020 forecast Scenario 2C HSR are estimated at:

↓# $96.7 billion total output
↓# 693,600 jobs
↓# $34.8 billion income
↓# $4.9 billion tax revenue

SCENARIO 8: 2020 RTP FORECAST ALTERNATIVE

Scenario 8 answers the question: "What impacts will the addition of an unconstrained El Toro and high speed rail services have on the air transportation system's ability to meet future demand?" Other specific criteria of Scenario 8 included that the March, Ontario, Palm Springs, Palmdale, San Bernardino International, and Southern California Logistics airports would be unconstrained. In addition, a new terminal is assumed for Burbank (9.4 MAP with 14 gates), while both John Wayne and LAX would be physically constrained to existing capacity. Long Beach would be legally constrained to 3.0 MAP and there no air transportation services would be offered at Point Mugu. (see Appendix G for detailed impacts).

Level-1 Total Economic Impacts: Scenario 8

Level-1 economic impacts based on 2020 forecast Scenario 8 will generate total direct, indirect, and induced impacts of:

↓# $29.9 billion total output
↓# 190,000 jobs
↓# $12.1 billion income
↓# $1.3 billion tax revenue.

Level-2 Total Economic Impacts: Scenario 2C HSR

Level-2 economic impacts based on 2020 forecast Scenario 8 will generate total direct, indirect, and induced impacts of:

↓# $60.9 billion total output
↓# 534,700 jobs
↓# $22.9 billion income
↓# $3.8 billion tax revenue

Level-3 Total Economic Impacts: Scenario 2C HSR

Level-3 economic impacts based on 2020 forecast Scenario 8 will generate total direct, indirect, and induced impacts of:

↓# $97.4 billion total output
↓# 700,500 jobs
↓# $35.1 billion income
↓# $5.0 billion tax revenue

SCENARIO 9: 2020 RTP FORECAST ALTERNATIVE

Scenario 9 answers the question: "What effect would the LAX master plan improvements have on the airport system, without El Toro, but with HSR. Everything else would be the same as in Scenario 8: no constraints on March, Ontario, Palm Springs, Palmdale, San Bernardino International, and Southern California Logistics; a new terminal is assumed for Burbank (9.4 MAP with 14 gates); both John Wayne and LAX would be physically constrained to existing capacity; Long Beach would be legally constrained to 3.0 MAP; and no air transportation service would be provided at Point Mugu. (see Appendix G for detailed impacts).

Level-1 Total Economic Impacts: Scenario 9

Level-1 economic impacts based on 2020 forecast Scenario 9 will generate total direct, indirect, and induced impacts of:

↓# $29.6 billion
↓# 187,900 jobs
↓# $12.0 billion income
↓# $1.3 billion tax revenue

Level-2 Total Economic Impacts: Scenario 9

Level-2 economic impacts based on 2020 forecast Scenario 9 will generate total direct, indirect, and induced impacts of:

↓# $61.3 billion total output
↓# 540,500 jobs
↓# $23.0 billion income
↓# $3.9 billion tax revenue

Level-3 Total Economic Impacts: Scenario 9

Level-3 economic impacts based on 2020 forecast Scenario 8 will generate total direct, indirect, and induced impacts of:

↓# $97.4 billion total output
↓# 704,500 jobs

↓# $35.1 billion income
↓# $5.0 billion tax revenue

SCENARIO 6: 2020 RTP FORECAST ALTERNATIVE

Scenario 6 answers the question: "Can the aviation system with existing legal and physical constraints meet future demand? Burbank would be physically constrained to 9.4 MAP. Ontario would be physically constrained to 20 MAP. Los Angeles International Airport and March Inland Port would be constrained to their existing physical capacity. John Wayne and Long Beach would be legally constrained to 8.4 MAP and 3.0 MAP, respectively.

Level-1 Total Economic Impacts: Scenario 6

Level-1 economic impacts based on 2020 forecast Scenario 6 will generate total direct, indirect, and induced impacts of:

↓# $26.9 billion total output
↓# 171,000 jobs
↓# $11.0 billion income
↓# $1.2 billion tax revenue

Level-2 Total Economic Impacts: Scenario 6

Level-2 economic impacts based on 2020 forecast Scenario 6 will generate total direct, indirect, and induced impacts of:

↓# $54.2 billion total output
↓# 474,100 jobs
↓# $20.5 billion income
↓# $3.4 billion tax revenue

Level-3 Total Economic Impacts: Scenario 6

Level-3 economic impacts based on 2020 forecast Scenario 6 will generate total direct, indirect, and induced impacts of:

↓# $87.0 billion total output
↓# 623,300 jobs.
↓# $31.6 billion income
↓# $4.4 billion tax revenue

ALTERNATIVE 2020 SCENARIOS: IMPACTS SUMMARY

The following table summarizes the results of the five alternative aviation development scenarios. In spite of large differences in the individual airport improvements and air traffic restrictions within the region, the resulting economic impact estimates are very similar with the exception of Scenario 6. Very little difference (about 2% in total output or employment) exists between the RTP Medium Scenario and Scenarios 2C-HSR, 8, and 9. This is not too surprising in that the scenarios yield very similar total regional passenger volumes and cargo shipments. Scenario 6 results in smaller total economic impacts, only because air passenger volumes are constrained to about 140 MAP compared to 157 MAP for the RTP Medium Scenario. As a result, Scenario 6 generates about 11.4% less economic impact for the region and 11.8% fewer jobs (-$11.2 billion and –83,000 jobs, respectively).

Table 9

SUMMARY OF LEVEL 1, 2, AND 3 SCAG REGION ECONOMIC IMPACTS FOR FIVE ALTERNATIVE 2020 AVIATION DEVELOPMENT SCENARIOS
(Dollar Amounts Stated in 1998 $Millions)

Economic Impact Estimates (Direct, Indirect, and Induced)	2020 Aviation Services Impact Scenarios				
	RTP Med	2C HSR	Sce #8	Sce #9	Sce #6
Level 1 - Air Transportation Services (Only)					
Output	$30,068 M	$29,815 M	$29,888 M	$29,573 M	$26,904 M
Income	$12,167 M	$12,070 M	$12,098 M	$11,977 M	$10,957 M
Employment	191,080	189,476	189,938	187,935	170,978
Indirect Business Taxes	$1,304 M	$1,293 M	$1,296 M	$1,283 M	$1,167 M
Level-2 Non-Resident Air Travelers (Only)					
Output	$31,397 M	$30,510 M	$31,045 M	$31,752 M	$27,300 M
Income	$10,907 M	$10,625 M	$10,801 M	$11,029 M	$9,577 M
Employment	348,471	338,808	344,787	352,566	303,164
Indirect Business Taxes	$2,559 M	$2,482 M	$2,525 M	$2,584 M	$2,221 M
Combined Levels-1, 2: Air Transportation Services and Non-Resident Air Traveler Impacts					
Output	$61,465 M	$60,325 M	$60,933 M	$61,325 M	$54,205 M
Income	$23,074 M	$22,695 M	$22,899 M	$23,006 M	$20,534 M
Employment	539,551	528,284	534,725	540,501	474,141
Indirect Business Taxes	$3,863 M	$3,776 M	$3,821 M	$3,867 M	$3,388 M
Level-3 Economic Impacts Derived From Air Transportation Of Locally Produced Foreign Exports (Only)					
Output	$36,700 M	$36,392 M	$36,481 M	$36,096 M	$32,839 M
Income	$12,243 M	$12,146 M	$12,174 M	$12,053 M	$11,025 M
Employment	166,736	165,336	165,739	163,991	149,194
Indirect Business Taxes	$1,147 M	$1,137 M	$1,140 M	$1,128 M	$1,026 M
Combined Levels-1, 2, 3: Air Transportation Services, Non-Resident Air Travelers, and Locally Produced Air Exports					
Output	$98,165 M	$96,718 M	$97,414 M	$97,421 M	$87,044 M
Income	$35,317 M	$34,841 M	$35,073 M	$35,059 M	$31,559 M
Employment	706,287	693,620	700,464	704,492	623,336
Indirect Business Taxes	$5,010 M	$4,913 M	$4,962 M	$4,995 M	$4,415 M

Source: CIC Research, Inc.

Figure 7

COMBINED TOTAL LEVELS-1, 2, AND 3 SCAG REGION ECONOMIC IMPACTS FOR FIVE ALTERNATIVE 2020 AVIATION DEVELOPMENT SCENARIOS
(Dollar Amounts Stated in 1998 $Millions)

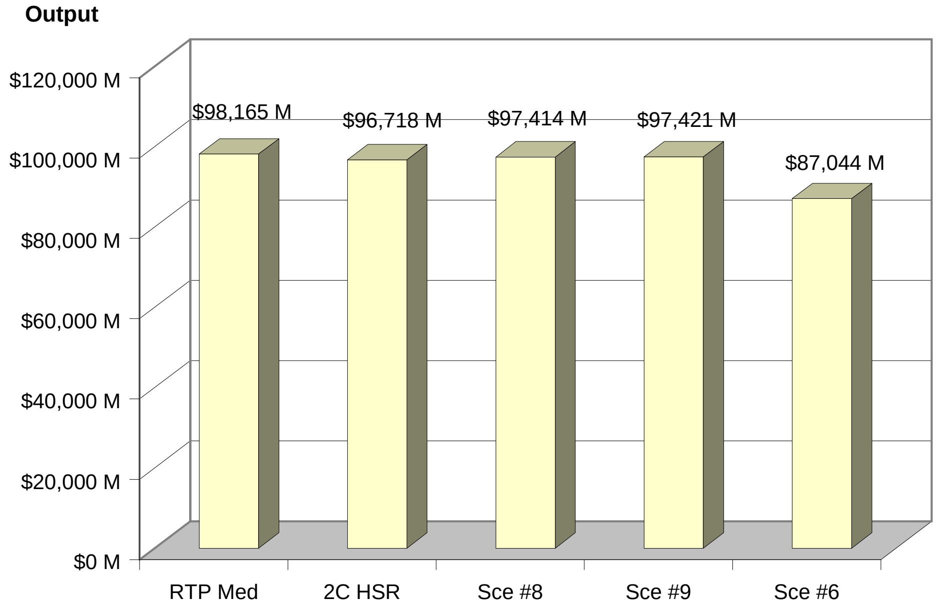
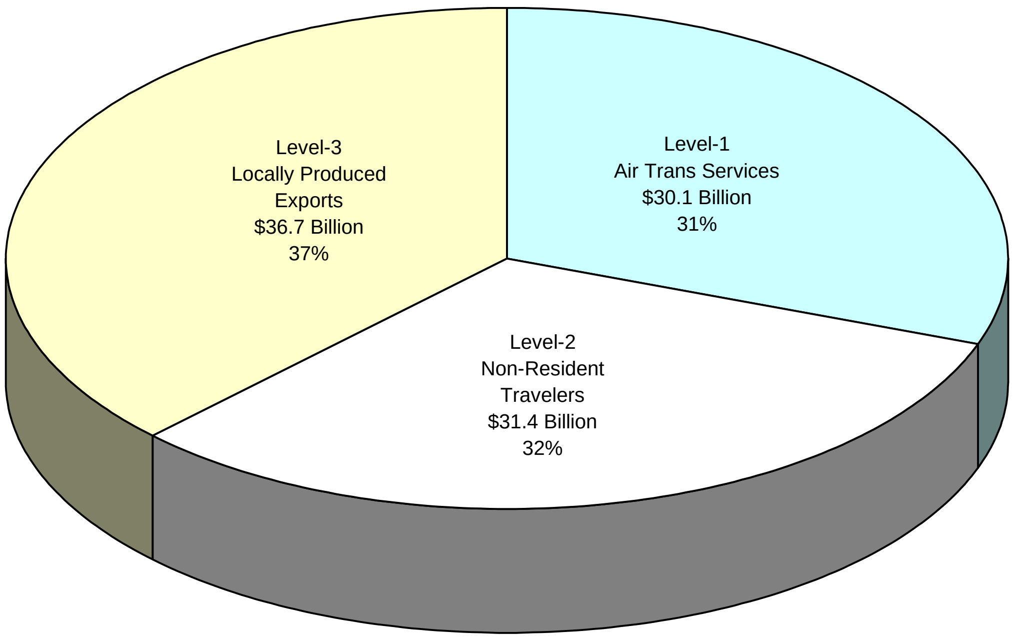


Figure 8

SCAG REGION 2020 RTP MEDIUM AVIATION DEVELOPMENT SCENARIO LEVELS OF ECONOMIC IMPACT



REGIONWIDE V. COUNTY-LEVEL IMPACTS

Although the region-wide economic impacts yield very little differences between the 2020 aviation development scenarios, there are large impact variations between scenarios at the County level. Nearly all of the variation at the county level occurs in terms of Level-1 economic impacts, *i.e.*, Air Transportation Services production. In general, the Level-2 non-resident air passenger expenditures and the Level-3 manufacturing exports by air are not impacted by the location of air transportation services within the region. However, it should be noted that the 2020 SCAG region aviation forecast scenarios and the RADAM demand allocation modeling, did not attempt to measure the level of air service demand as a result of changes in regional air service location.

One might reasonably assume that air travelers and air cargo shippers would prefer to use airports that are the most convenient to their origin and destination. However, the RADAM modeling indicates that price, flight frequency, air carriers, and other factors significantly impact the choice of airport usage. This further supports the lack of variation in the regionwide economic impact estimates resulting from the very small differences in total passenger and cargo volume among the five regional forecast scenarios.

Air Passenger Impacts. Once on the ground the non-resident air traveler demonstrates a pattern of visitation within the region that is largely unaffected by the location of the airport within the region. For example, business travelers will travel to the location of their client's office and many leisure travelers will visit Disneyland or Universal Studios regardless of the location of the airport within the region. Consequently, we can say with some assurance that whatever the county distribution of economic impacts related to air passengers, the total regional impact is little affected by any of the forecast scenarios. However, it would seem reasonable to assume that to the extent that the in-region distribution of air passenger landings better reflects the regional origin or destinations of passengers once on the ground, the demand for inter-county ground transportation would be reduced. This suggests that planning for the future of aviation in the region may be more strategically related to environmental and transportation congestion issues than to future economic impacts.

Cargo Impacts. The location of most industries that use air transportation services to export their products manufactured within the region would be largely unaffected by any of the aviation forecast scenarios. This conclusion is substantially supported by the results of the RADAM air cargo shipment allocations by origin/destination airport within the region. The SCAG estimate of 80 percent leakage of San Diego County origin/destination air cargo through LAX, further supports the minimal in-region airport location impacts of air cargo service.

Infrastructure and Catalytic Impacts. This study has not addressed the economic impacts of the substantial capital investment in new aviation and related transportation infrastructure or the value of catalytic impacts resulting from the alternative scenarios. In this case, along with the impacts associated with new construction to expand or create new airports, there would be additional construction to expand or create new industrial facilities that would be attractive to those economic activities that have a high propensity to locate near airports.

COUNTY LEVEL ECONOMIC IMPACTS

County Distribution of Air Transportation Services (Level 1) Output Impacts

Under each 2020 aviation forecast scenario, including the RTP Medium (*i.e.*, the baseline forecast), Los Angeles county airports would account for a much smaller percentage of the region's total air transportation services than today. The largest increases in air transportation services outside of L.A. County are generated by shifts in the greatly expanded air cargo market. Currently, airports located within Los Angeles County generate more than 80 percent of the total air passenger and air cargo volume for the SCAG region. However, by 2020

Los Angeles county airports will account for 68 percent of the passengers and only 46 percent of the total regional air cargo.

Under scenarios where a new Orange County International Airport is developed at El Toro, Orange County would act as the primary reliever for expanding air passenger volumes in the region. Under all of the scenarios, there are greatly expanded air cargo services offered in San Bernardino and Riverside Counties. The greatest redistribution of air transportation services would occur under the high-speed rail scenario 2C HSR. The smallest redistribution of air transportation services would take place under Scenario 6 which because of existing constraints would also result in smaller growth in both Los Angeles and Orange Counties, as well as for the region as a whole. Overall variability is relatively small except for Scenario 6 which is about 11 percent lower primarily because of constraints at both LAX and John Wayne.

The largest difference for any county between one scenario condition and the others is the development of El Toro. This development is present in SCE RTP, SCE 2C HSR and SCE 8. It is not present in SCE 9 and SCE 6. With the El Toro airport and high-speed rail (SCE 2C HSR), the smallest proportion of air transportation services is allocated to L. A. County of any of the forecast scenarios (53% of passengers and 32% of cargo). Without El Toro but with HSR, (SCE 9) the reductions in Orange County occur with a substantial expansion in San Bernardino County. This is also the only scenario in which a county that presently offers a substantive level of air transportation services would experience an actual reduction in economic impact.

Table 10

LEVEL-1 ECONOMIC IMPACTS OF AIR TRANSPORTATION SERVICES BY COUNTY FOR FIVE SELECTED 2020 AVIATION DEVELOPMENT SCENARIOS
(Dollar Amounts Stated in 1998 $Millions)

Impact Category/ County	SCE RTP	SCE 2C HSR	SCE 8	SCE 9	SCE 6
Output Impact:					
Los Angeles	$18,487 M	$13,883 M	$15,572 M	$17,160 M	$16,391 M
Orange	$5,196 M	$6,935 M	$5,939 M	$1,024 M	$2,231 M
San Bernardino	$4,424 M	$6,628 M	$6,471 M	$8,490 M	$5,359 M
Riverside	$1,749 M	$1,814 M	$1,905 M	$2,898 M	$2,915 M
Ventura	$212 M	$555 M	$0 M	$0 M	$8 M
Total	$30,068 M	$29,815 M	$29,888 M	$29,573 M	$26,904 M
Income Impact:					
Los Angeles	$7,481 M	$5,620 M	$6,303 M	$6,950 M	$6,675 M
Orange	$2,102 M	$2,807 M	$2,404 M	$415 M	$908 M
San Bernardino	$1,790 M	$2,683 M	$2,619 M	$3,439 M	$2,183 M
Riverside	$708 M	$735 M	$771 M	$1,174 M	$1,187 M
Ventura	$86 M	$225 M	$0 M	$0 M	$3 M
Total	$12,167 M	$12,070 M	$12,098 M	$11,977 M	$10,957 M
Tax Revenue Impact:					
Los Angeles	$802 M	$602 M	$675 M	$744 M	$711 M
Orange	$225 M	$301 M	$258 M	$44 M	$97 M
San Bernardino	$192 M	$287 M	$281 M	$368 M	$232 M
Riverside	$76 M	$79 M	$83 M	$126 M	$126 M
Ventura	$9 M	$24 M	$0 M	$0 M	$0 M
Total	$1,304 M	$1,293 M	$1,296 M	$1,283 M	$1,167 M
Employment Impact:					
Los Angeles	117,485	88,228	98,963	109,052	104,166
Orange	33,020	44,071	37,742	6,508	14,177
San Bernardino	28,114	42,122	41,125	53,955	34,058
Riverside	11,117	11,531	12,108	18,420	18,523
Ventura	1,344	3,524	-	-	52
Total	191,080	189,476	189,938	187,935	170,978
Percentage Of County Employment:					
Los Angeles	1.6%	1.2%	1.4%	1.5%	1.4%
Orange	1.1%	1.4%	1.2%	0.2%	0.5%
S.B. / Riverside	1.5%	2.1%	2.1%	2.8%	2.0%
Ventura	0.2%	0.5%	0.0%	0.0%	0.0%
Total	1.4%	1.4%	1.4%	1.4%	1.2%

Source: CIC Research, Inc.

Figure 9

LEVEL-1 OUTPUT IMPACTS OF AIR TRANSPORTATION SERVICES BY COUNTY FOR FIVE SELECTED 2020 AVIATION DEVELOPMENT SCENARIOS
(Dollar Amounts Stated in 1998 $Millions)

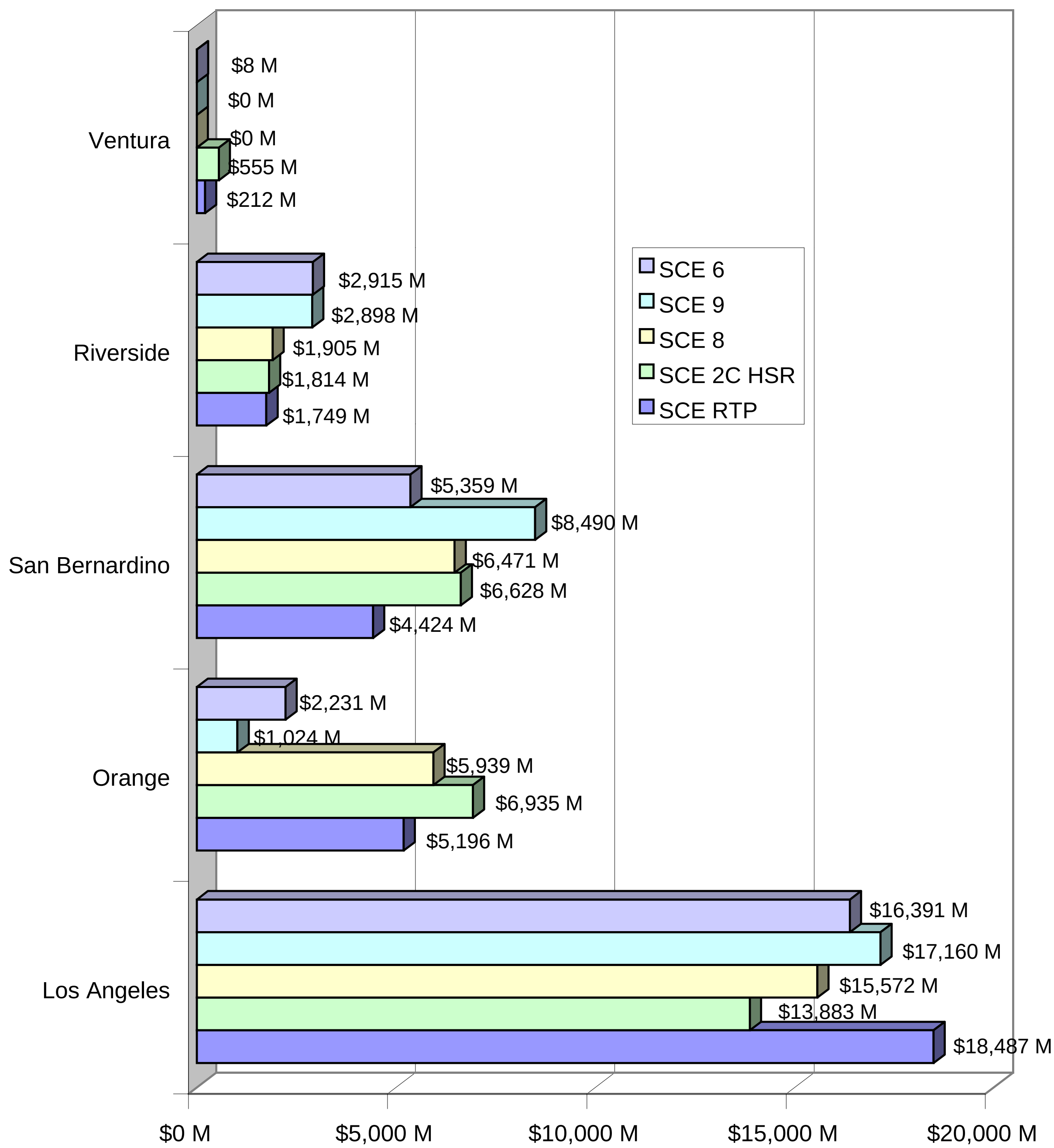
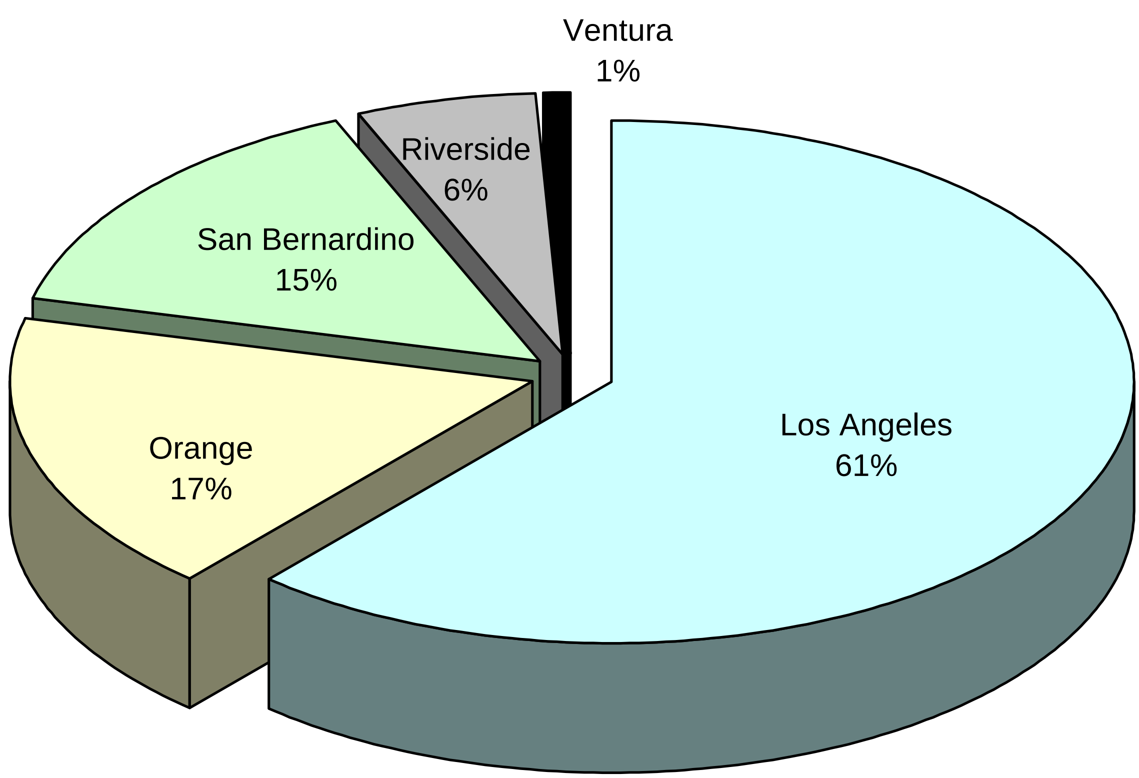


Figure 10

2020 RTP MEDIUM SCENARIO FORECAST

EMPLOYMENT IMPACTS OF AIR TRANSPORTATION SERVICES BY COUNTY

(191,000 Total Jobs)



For each of the alternative aviation development scenarios the resulting economic impacts by county represent two percent or less of the total economy of each county, respectively. Even though the impact of Scenario 2C-HSR has seven times the impact of Scenario 9 on the Orange County economy, the resulting difference of 37,600 jobs (44,100 jobs v. 6,500 jobs), still represents only about 1.5 percent of the total countywide employment in 2020. Therefore, while there are measurable differences in the relative county-level impacts of the alternative regional aviation forecasts, the resulting impact levels do not represent a substantial economic loss or benefit to the individual counties.

A P P E N D I C E S

A. Economic Impact Methodology

B. Summary of Regional Airport Studies

C. Foreign Trade

D. SCAG Region Economic Shift Share Analysis

E. Forecast Scenarios and 2020 SCAG Region Economy (Historical air passenger and air cargo volumes)

F. 55-Sector Model Summary of Economic Impacts by Forecast Scenario

G. Detailed 55-Sector Model Economic Impacts by Forecast Scenario

APPENDIX A

ECONOMIC IMPACT METHODOLOGY

Airport Impact Study Variations From Classical Analysis

Most recent studies of the regional economic significance of airports follow to some extent a methodology discussed in a 1992 study by the FAA.[32] The methodology basically follows the logic of economic input-output analysis in that it classifies impacts into three categories: 1) direct impacts, 2) indirect impacts, and 3) induced impacts. The direct impacts are defined as deriving mainly from on-site "economic activities carried out by airlines, airport management, fixed base operators, and other tenants with a direct involvement in aviation. Direct impacts, however, include not only direct employment and direct "airport construction and capital improvements," but include as well, off-site {production of goods and services that are used at the airport". This is similar to the definition in input-output analysis of the direct requirements used in the production of air transportation services. However, it differs by the inclusion of "airport construction and capital improvements" which in most static input-output models is treated as exogenous in a production function for air transportation services.[33]

Indirect Impacts. There is also a departure from conventional I-O analysis in the definition of indirect impacts, which are "derived primarily from off-site economic activities that are attributable to the airport." Mentioned indirect activities include "travel agencies, hotels, restaurants, and retail establishments," except for those located on-site which are included with the direct economic impacts. This is different in several ways from the conventional definition of indirect impacts. It includes all purchases by these businesses including capital expansion and improvements, which, as in the case of direct impacts, would be excluded in a static, input-output model analysis. More significantly, however, the more traditional application of input-output analysis would exclude all of these activities except those that are linked to the direct purchases made by the air transportation sector.

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[32] Butler, Stewart E. & Lawrence J. Kieman, Estimating the Regional Economic Significance of Airports. 1992.
[33] No analysis of the economic impact of the construction or expansion of airports is planned in the present study. This analysis would take more resources than have been allocated to this study. Moreover, the comparisons of

The logic for the connection to the above sectors is made because many of the passengers on aircraft use “travel agencies, hotels, restaurants, and retail establishments.” The article does suggest that “it would be desirable to distinguish between visitors who would not have traveled to the region if there were no airport, and those who would have come anyway by some other form of transportation.” However, the more conventional application of input-output economic impact analysis would not include these visitor impacts at all. That is to say, transporting passengers does not give license to a claim to any impact produced by those passengers beyond those businesses and economic resources required for the production of the transportation service itself. The argument for their inclusion is based strictly on the desire to find a measure of all of the region’s economic activity that would not occur if not for the presence of air transportation services.

Induced Impacts. Induced impacts are defined the same way in the FAA guidelines as conventional input-output economic impact analysis. It is produced by the expenditures made by all of the local residents who directly or indirectly receive income from the economic activities counted in the direct and indirect impacts. It also includes spending from income resulting from locally produced goods and services that are purchased from induced employment and income, and so forth through successive rounds of earnings and expenditures giving rise to the term “multiplier effects.” As stated, this is the conventional application of input-output analysis of induced effects. However, to the extent the analysis is applied to direct and indirect effects that are not included in a conventional I-O analysis, the induced impacts derived from them would likewise be overstated. Further discussion of the peculiarities involved in these departures will be made below in a discussion of some of the applications to specific airport studies.

In this study CIC Research was careful to differentiate between what was included and what was excluded in the input-output analysis. This was done by first estimating the regional total direct, indirect, and induced impacts of producing air transportation services only (Level-1: core economic impacts). At the next level of impact activity the regional total direct, indirect, and induced impacts associated with producing the goods and services demanded by non-resident air passengers (Level-2 impacts) are estimated. This still leaves out air cargo impacts, at least explicitly. To the extent air cargo is part of airport operations, it is of course covered by the Level-1 impacts. However, some of the impacts of air cargo can be identified separately as a forward linkage to goods produced within the region (Level-3 impacts). Moreover, air cargo is

economic impact would be influenced by the considerable differences in the expected capital outlays for different scenarios.

much more interesting from the “catalytic” impact point of view and its rapid growth is revealed preference testimony that the benefit of delivery speed is greater than its relatively higher cost.

The Economic Input-Output Model. This study uses IMPLAN software and data to develop regional input-output models for the SCAG area. The IMPLAN methodology reduces the benchmark 1987 BEA national input-output model to regional proportions using regional purchase coefficients derived from local area data.[34] The 1987 BEA benchmark model has a single air transportation sector, but it also has a separate sector for SIC 4311 U.S. Postal Service, which aids in the analysis of air cargo. Further detail on air cargo is derived from the RADAM air cargo module; from data provided by airports and airlines, and from freight forwarders, shippers, and consolidators.

Supporting analysis of air cargo was made by examining the regional economy in its capacity as a major U.S. port, with information on exports and imports blended with the economic input-output analysis to assess the role of the region's air cargo activity in a more global context. The IMPLAN models also predict the level of imports and exports, foreign and domestic. These estimates compared to actual data are useful to the analysis of air cargo, and provide a means as well for assessing the merits of the IMPLAN model and making adjustments where needed to the regional purchase coefficients.[35]

DEFINITION OF ECONOMIC IMPACT

The definition of economic impacts may vary depending on the study objectives and the study authors. For this study CIC Research has employed a classical input-output model approach to the definition and measurement of economic impacts. Taking economic analysis one step at a time should help clarify what is meant by economic impact. For example, the 1996 IMPLAN input-output model for the SCAG region estimates air transportation output at $7.2 billion, employment of 66,170, employee compensation of $2.9 billion, and total value added of $4.0 billion. By 2020 air transportation services are projected to reach $18 billion in output, 110,000 employees, with income of $7.8 billion. The $7.2 billion is an estimate of the benefits received by the users of air transportation services. It is a "revealed preference" for air transportation, meaning they were willing to give up $7.2 billion to get the services. That is, air transportation service users paid $7.2 billion (costs) to receive (at least) $7.2 billion of benefits. Beyond this, cost benefit analysis becomes somewhat esoteric.

[34] Olson, Doug and Scott Lindall, "IMPLAN Professional Software, Analysis, and Data Guide" ,Minnesota IMPLAN Group, Inc., 1996.
[35] Olson, Doug and Scott Lindall, "IMPLAN Professional Software, Analysis, and Data Guide" ,Minnesota IMPLAN Group, Inc., 1996.

Economic Impact Analysis: In providing the $7.2 billion of services, the Air Transportation sector used 66,170 employees, who were paid $2.9 billion, which was the principle part of the $4.0 billion in value added produced by the sector in the region. The latter figure represents air transportation's contribution to the Gross Regional Product of the SCAG region. There is no reason to double count any of these numbers. The $2.9 billion is included in the 4.0 billion, and the $4.0 billion is included in the $7.2 billion.

Applying multipliers to these figures must be done cautiously, and usually only in the context of changes in final demand for air transportation services. The associated multipliers are shown in Table A-1. The proportion of sales that are to final demand is shown in Table A-2. The first column of Table A-1 shows that for one million dollars sales to final demand, there is a direct impact of $1.0 million, an indirect impact of $335,000 and a $429,000 induced impact for a total impact of $1.764 million. (Type I multiplier times direct = direct + indirect = $1.335 million; Type 2 multiplier times direct = direct + indirect + induced = $1.764 million).

The employment row is interpreted in the same manner: Total employment required to sell $1.0 million of air transportation services is 9.163 direct jobs. The production of the $335,000 indirect output requires an additional 3.113 employees within the region's industries. Additional employment required to produce the output required to cover the $429,000 of induced output is 5.339 jobs for a total employment of 17.615. This is the total "direct indirect and induced" employment required to produce one million dollars of Air Transportation Services in the SCAG region.

Table A-1

SCAG REGION AIR TRANSPORTATION - MEASURES OF ECONOMIC ACTIVITY
(Dollar Amounts in $Millions)

Measure	Direct Effects	Indirect Effects	Induced Effects	Total	Type I Multiplier	Type II Multiplier
Output	$1.000	$0.335	$0.429	$1.764	1.335	1.764
Employment	$9.163	$3.113	$5.339	$17.615	1.340	1.922
Total Value Added	$0.556	$0.175	$0.269	$0.999	1.314	1.797
Personal Income	$0.418	$0.116	$0.164	$0.698	1.276	1.669
Employee Compensation	$0.400	$0.095	$0.139	$0.633	1.237	1.585
Other Property Type Income	$0.107	$0.045	$0.077	$0.229	1.426	2.147
Indirect Business Taxes	$0.031	$0.013	$0.028	$0.072	1.430	2.317

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

Table A-2

SCAG REGION AIR TRANSPORTATION – PURCHASES / SALES BY SECTOR
(Dollar Amounts in $Millions)

Sector	Purchases/ Payments	Percentage of Total	Sales/ Demand	Percentage of Total
Total Intermediate	$1,793.9	24.8%	$984.5	13.6%
Resident Households	$2,885.5	40.0%	$1,122.2	15.5%
Other In Region Final Payments / Sales	$1,145.8	15.9%	$269.4	3.7%
Domestic Trade	$1,337.8	18.5%	$2,548.8	35.3%
Foreign Trade	$58.7	0.8%	$2,296.9	31.8%
Total	$7,221.7	100.0%	$7,221.7	100.0%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

Any assessment of economic impact that goes beyond these numbers, must rely on some additional impact criteria. There are two ways specified in the literature.[36] One relates to the spending behavior (excluding air transportation expenditures) of non-resident air passengers, while in the region. The other relates to the role of air transportation as a catalyst for the location of industry in the region that would otherwise locate elsewhere.

Comparative Economic Impacts

This study's primary focus is not so much on the actual economic impacts of airports and aviation or even how future changes in airports and aviation effect the economic impacts. Rather, the focus is on comparing economic impacts between various scenarios of future air

[36] Actually there are three ways if the concept of consumer surplus is introduced. Consumer surplus increases the amount of an expenditure a person makes for a service, to an amount that the person would have been willing to make had he not been able to make a better deal. This has been argued to be a better estimate of the total benefit received by the user. The problem is, it is impossible to measure.

transportation services supply and demand. For this reason more is made of consistency in the assessment of economic impacts between scenarios, than of capturing the totality of economic impact of a given scenario. A measure that can be applied uniformly between different scenarios is therefor preferred to one that is likely to treat one scenario more favorably than another even if the measure has more appeal in terms of capturing the full economic benefits of aviation. For this reason conservative estimates are preferred, and the focus applied to assessing the essential differences between scenarios.

There are a number of ways economic impacts can vary depending on the future air traffic volumes at different airports in the region. 1) The overall volume of air traffic (passengers and/or cargo) can differ; 2) the mix of passengers (types) can differ; and or the mix of passenger and cargo can differ; and 3) the catalytic effects can differ. The effort here will focus on developing a model that can assess the differences in economic impacts for exogenous specified changes in these elements. This is done by first developing a baseline economic impact scenario. These economic impacts are then compared to those from alternate scenarios each having certain specified differences in basic airport volumes (passengers and cargo) at various airports.

APPENDIX B

SUMMARY OF PRIOR REGIONAL AIRPORT STUDIES

Wilbur Smith Associates (a transportation consulting firm) has conducted a number of specific airport economic impact studies, including studies of LAX, John Wayne, Van Nuys, and Ontario airports.[37] Each of these studies follows the FAA approved methodology except that the precaution to limit air passenger impacts to just those who would not have come to the area without air transportation seems to be waived as too difficult to determine. In these studies, direct impact is defined as all economic activity at the airport, and all off-site activity that supplies inputs to any activity at the airport, (these are limited to Southern California producers). Indirect impacts include all expenditures by non-resident air passengers, including flight crew layovers, and air transportation expenditures by Southern California resident air passengers, including travel agencies. Indirect impact also includes air cargo and reflects the "value of outbound freight."

Application of Economic Multipliers. The Wilbur Smith Associates studies, make a conceptual leap, which is probably in the interpretation of the vague language in FAA guidelines, when it equates these defined direct and indirect impact measurements to **final demand** then applies RIMS- II multipliers to estimate induced impacts.[38] RIMS-II multipliers are defined as the sum of the direct, indirect, and induced effects (as measured by output, employment or income) divided by the direct effects. The RIMS-II multipliers are therefore ratios which by definition when multiplied times the direct effect gives the total (direct plus indirect plus induced) effect. A multiplier that would be somehow applied to both the direct and indirect effect would be a ratio of total (direct plus indirect plus induced) divided by (direct plus indirect), which obviously would be a much smaller ratio. There are apparently problems here in the interpretation of language associated with what is a precise mathematical formula, in fact, an identity. This probably explains why the induced effects alone in Wilbur Smith Associates

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[37] Reports include Economic Impact Updates for the City of Los Angeles, Department of Airports for LAX, ONT, and VNY, by Wilbur Smith Associates, all in 1992.

[38] Cartwright Joseph V., Richard M. Beemiller and Richard D. Gustely, "RIMS II Regional Input-Output Modeling System, U.S. Department of Commerce, Bureau of Economic Analysis, 1981.

studies are three times as large as the direct and indirect effects combined, and over twice as large as the total earnings impact. Stated another way, expenditures from earnings (definition of induced effects) are more than double earnings, a good trick even in a zero personal savings economy.[39]

It is reasonably clear from the example provided in the FAA guidelines that induced effects are derived from expenditures out of income directly or indirectly attributable to air transportation services. To be more specific, they are the product of multipliers applied to the ***earnings*** of people directly or indirectly employed as a result of aviation services. "…induced impacts are the multiplier effects of employment, payroll, and <u>other direct (and indirect) ***consequences*** of airport activity.</u>" The hypothetical example in the FAA guidelines applies a multiplier to the airport payroll that is magnitude 1.0 or less, depending of the population of the region. However, it then applies the same multiplier to ***all*** of the airport's indirect effects. In other words, spending from payroll is the source of induced effects, except where passenger spending is involved. In this case, it is not just the payroll of those economic activities supplying air passengers, rather it is total sales to air passengers, although the language is "value added expenditure" rather than sales.

<u>**Inappropriate Application of Economic Multipliers**</u>**.** Perhaps using multipliers of magnitude 1.0 or less makes up for including amounts in indirect impacts beyond earnings. However, RIMS-II multipliers are all greater than 1.0, in fact, in most cases they are greater than 2.0. Moreover, they are not ratios of the total divided by the direct plus indirect, they are total divided by direct. The expanded amounts in the definition of direct and indirect plus the enlarged multiplier, combine to make a total economic impact that is an order of magnitude larger than what a more conventional application of input-output analysis would yield.

At the other end of the interpretation of the FAA guidelines are studies made by Martin O'Connell on the economic impacts of Dulles and National airports in the Washington D.C. area. In these studies, multiplier effects were limited to type I on output, (direct and indirect effects) and induced impacts on output only attributable to earnings impacts. This results in total impacts of much lower than two times direct impacts. No estimates were made of visitor related impacts, perhaps an acknowledgement that all air passengers would have arrived anyhow either using another airport, or some other of the many transportation links to the Nations Capital. The jobs per MAP (1,607 Dulles and 1,382 National) are also orders of magnitude

[39] See page 2-7 in Economic Impact Update: Los Angeles International Airport (LAX) Wilbur Smith Associates, 1992.

lower than Wilbur Smith's (6,691 LAX, 8,799 Ontario, and 22,924 John Wayne).[40] The differences are similar when comparing output measures per MAP ($150 million Dulles, $187 million National, $844 million LAX, $1 billion Ontario, and $577 million John Wayne).[41]

Other studies, have found a more middle ground in application of the economic methodology outlined by the FAA. These studies tend to find employment impacts in the 2,000 to 3,000 per MAP, and output impacts in the $300 million to $400 million range.

[40] Data are taken from Appendix B Table B-1 "A New Orange County Airport at El Toro: An Economic Benefits Study," Steven P. Erie, et al, 1998.
[41] The application of RIMS II multipliers to the "direct and indirect" effects appears to have been used to estimate "induced" effects rather than total effects, to get the total, they once again include the direct and indirect, in effect double counting it.

Table B-1

SUMMARY COMPARISON OF AIRPORT IMPACT STUDIES

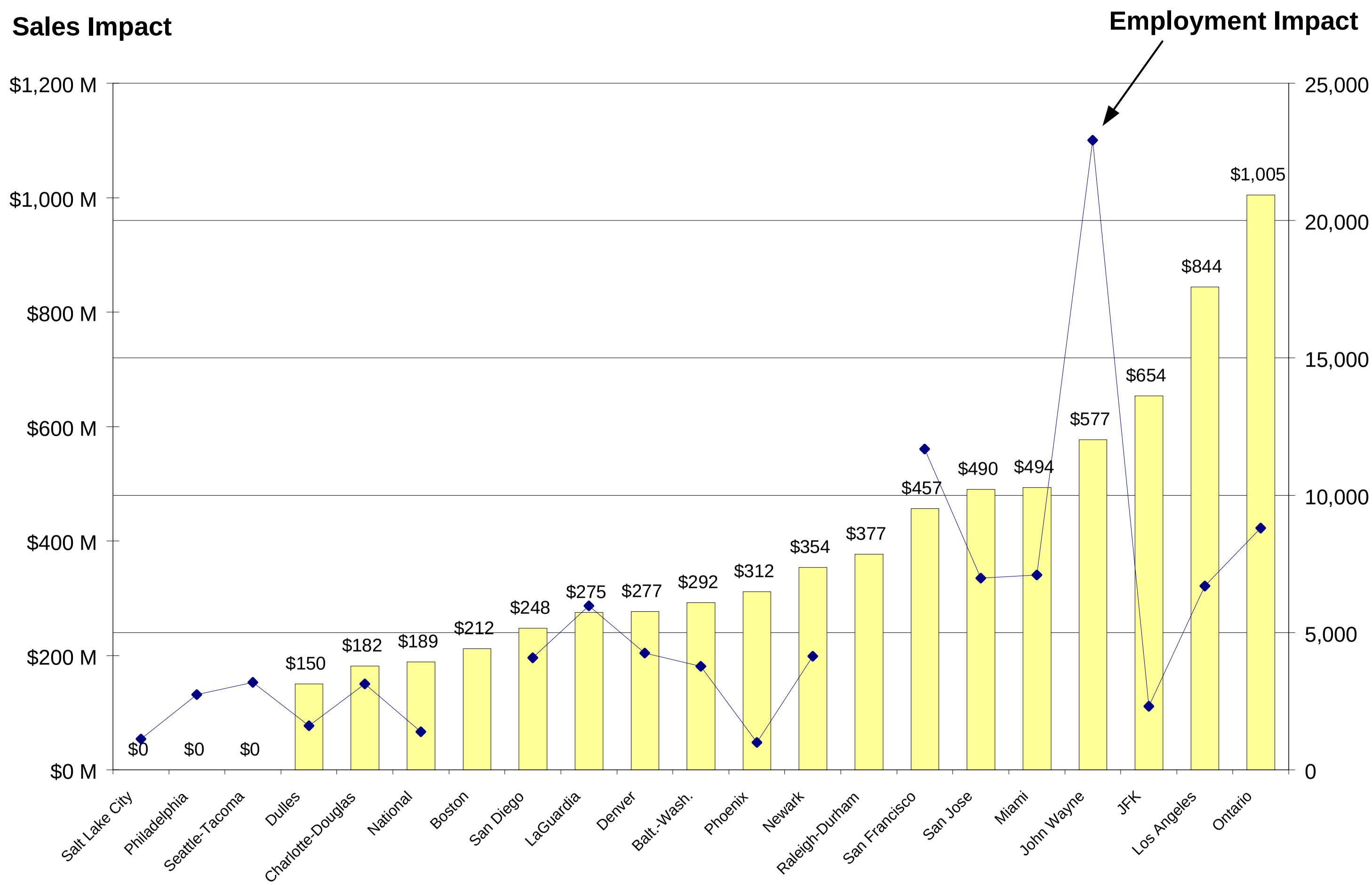
Airport (Ranked By Total Impact Per MAP*)	Economic Impact Study Author	Economic Impact Study Base Year	MAP* For Base Year Of Study	MAP 1997	Cargo Tonnage 1997	Economic Impact Per MAP: Direct Impact ($Millions)	Economic Impact Per MAP: Total Impact ($Millions)	Economic Impact Per MAP: Total Jobs
Selected Airport Economic Impact Studies:								
1. Ontario	Wilbur Smith	1993-4	5.4	6.3	418,709	$76.5	$1,004.6	10,265
2. Los Angeles	Wilbur Smith	1992	43.8	60.1	1,872,528	$76.0	$844.2	9,189
3. JFK	NY/NJ Port	1997	31.2	31.2	1,661,400	$211.5	$653.8	2,313
4. John Wayne	Wilbur Smith	1992	6.1	7.7	18,579	$47.4	$577.0	9,355
5. Miami	Landrum Brown	1997	25.0	34.5	1,765,827	$43.9	$493.6	7,093
6. San Jose	O'Connell	1995	8.1	10.2	110,697	$111.4	$490.1	8,796
7. San Francisco	O'Connell	1994	31.3	40.5	779,923	N.A.	$456.9	15,112
8. Raleigh-Durham	UNC Charlotte	1990	5.9	6.7	90,158	N.A.	$377.1	10,343
9. Newark	NY/NJ Port	1998	29.1	30.9	1,048,954	N.A.	$354.0	4,431
10. Phoenix	FAA	1993	30.8	30.5	314,653	$159.1	$311.7	4,157
11. Balt.-Wash.	Wilbur Smith	1996	13.2	14.1	199,725	$45.2	$292.3	4,040
12. Denver	Wilbur Smith	1998	32.0	35.0	437,108	$30.1	$276.6	4,650
13. LaGuardia	NY/NJ Port	1997	20.7	21.6	84,069	$0.0	$275.4	3,487
14. San Diego	SourcePoint	1998	14.3	14.3	124,309	$139.9	$247.7	4,084
15. Boston	Massport	1996	25.1	25.5	440,879	$58.6	$211.7	
16. National	O'Connell	1991	11.9	15.8	48,234	$111.0	$188.7	885
17. Charlotte-Douglas	O'Connell	1998	22.0	22.8	194,031	$177.0	$181.7	3,131
18. Seattle-Tacoma	O'Connell	1996	18.8	24.7	393,485	$154.3	$181.0	3,187
19. Dulles	O'Connell	1991	15.4	13.6	351,296	$114.9	$150.0	6,875
20. Philadelphia		1996	16.0	22.4	492,349	$4.6	$68.8	1,894
21. Salt Lake City	Univ.of Utah	1990	12.6	21.1	253,207	$59.5	$14.4	1,128
Southern California Aviation Industry Impact Summary:								
Level-1 Air Trans Srvcs	CIC Research	1998 / 2020	157.4	79.8	2,607,507	$114.9	$191.0	1,214
Level-2 Air Srvcs & Non-resident air travelers	CIC Research	1998 / 2020	157.4	79.8	2,607,507	$217.1	$390.5	2,214

* MAP = millions of annual air passengers (enplaned and deplaned)

Source: CIC Research, Inc.

Figure B-1

COMPARISON OF OUTPUT AND EMPLOYMENT IMPACTS FOR SELECTED AIRPORT STUDIES



APPENDIX C

FOREIGN TRADE

EXPORTS AND IMPORTS

Rapid growth in exports and imports through California ports help to fuel the economic recovery in California and the SCAG region from the recession of the early 1990s. Growth in exports averaged over 10 percent per year, during the decade, while imports were growing at slightly under nine percent. The rapid growth in the water-borne shipment of international trade accounts for a lot of this increase. Still, air cargo tonnage increased during the period by 54 percent, which suggests that air shipments were holding onto their share of a growing market.

Table C-1

FOREIGN TRADE THROUGH CALIFORNIA PORTS, 1990 TO 1997*

	Exports		Imports		Total	
Year	$millions	Percent Change	$millions	Percent Change	$millions	Percent Change
1990	$68,552	8.7%	$97,122	3.2%	$165,673	5.4%
1991	$73,860	7.7%	$100,744	3.7%	$174,604	5.4%
1992	$81,139	9.9%	$111,548	10.7%	$192,687	10.4%
1993	$82,174	1.3%	$125,348	12.4%	$207,522	7.7%
1994	$95,615	16.4%	$144,002	14.9%	$239,617	15.5%
1995	$116,825	22.2%	$165,045	14.6%	$281,870	17.6%
1996	$124,291	6.4%	$169,980	3.0%	$294,271	4.4%
1997	$131,292	5.6%	$184,791	8.7%	$316,084	7.4%
90-96 Ave.	$91,779	10.4%	$130,541	8.9%	$222,321	9.5%
90-97 Ave.	$96,719	9.8%	$137,322	8.9%	$234,041	9.2%

* Data reflect value of trade through California customs districts and not value of exported goods originating in California or imported goods destined for California.

Source: U.S. Department of Commerce, Bureau of the Census. http://www.census.gov/
Department of Finance, Financial and Economic Research (916) 322-2263.

Table C-2

VALUE OF EXPORTS AND IMPORTS THROUGH CALIFORNIA PORTS BY ALL MODES OF TRANSPORTATION, 1990 TO 1996 ($millions)

Year	California		San Francisco c/		Los Angeles d/		San Diego e/	
EXPORTS								
1990	$68,552	8.7%	$23,117	7.8%	$42,069	9.0%	$3,366	11.8%
1991	$73,860	7.7%	$23,893	3.4%	$46,050	9.5%	$3,917	16.4%
1992	$81,139	9.9%	$27,188	13.8%	$49,400	7.3%	$4,551	16.2%
1993	$82,174	1.3%	$29,392	8.1%	$48,280	-2.3%	$4,502	-1.1%
1994	$95,615	16.4%	$34,195	16.3%	$55,835	15.6%	$5,585	24.1%
1995	$116,779	22.1%	$43,691	27.8%	$67,004	20.0%	$6,083	8.9%
1996	$124,120	6.3%	$47,723	9.2%	$68,923	2.9%	$7,473	22.9%
IMPORTS								
1990	$97,122	3.2%	$28,141	3.2%	$64,592	2.9%	$4,389	8.5%
1991	$100,744	3.7%	$29,308	4.1%	$66,651	3.2%	$4,785	9.0%
1992	$111,548	10.7%	$33,386	13.9%	$72,581	8.9%	$5,580	16.6%
1993	$125,349	12.4%	$38,910	16.5%	$80,170	10.5%	$6,268	12.3%
1994	$144,002	14.9%	$46,308	19.0%	$90,239	12.6%	$7,455	18.9%
1995	$165,222	14.7%	$59,114	27.7%	$97,177	7.7%	$8,930	19.8%
1996	$169,981	2.9%	$57,804	-2.2%	$101,185	4.1%	$10,992	23.1%

a/ f.a.s. Value Basis b/ Custom Value Basis
c/ Customs district extends from northern California border south to Monterey Bay, and east to Salt Lake City.
d/ Customs district extends from south of Monterey Bay to Carpinteria and east to Las Vegas.
e/ Customs district extends from San Diego east to Phoenix.
Source: U.S. Department of Commerce, Bureau of the Census, Highlights of U.S. Export and Import Trade (FT 990), December, (1984-1988) and U.S. Exports and Imports of Merchandise on CD-ROM (1989 forward).
Department of Finance. Financial and Economic Research Unit (916) 322-2263.

There are indications that some of the expanded imports are attributable to production moving off shore. For example, the leading import “Computer storage devices and parts” is associated with a significant negative shift (9.4%) in the region’s share of the Computer Storage Device sector, a shift that cost the region almost 3,000 jobs. Similar losses occurred in Computers, Computer Peripheral Equipment, and other computer related manufacturing, in all totaling a loss of over 15,000 jobs in the region. The aviation sector’s role in these reallocations is informative, since one of the main features of the new global economy is that manufacturing will seek more efficient (lower cost) locations and rely on transportation to move products back into areas where they used to be produced. That “big sucking noise” mentioned by Ross Perot wasn’t just jobs leaving the country, it was the sound of jet engines returning with the products made offshore.

The example of aviation’s role in increased goods in motion accompanying movements of domestic production to lower wage countries, is in sharp contrast to the previous analysis of aviation clustering with other “visitor related“ activities. It the case of visitors, everybody wins. The visitor industries cluster is an example of a complementary relationship among different economic activities. In the second case, aviation’s gain is other activities’ loss, or at least other employees loss. That is, by moving production off shore, companies gain lower cost production, aviation gains new cargo business, but the employees of factories that shifted to off shore production wind up having to make an adjustment. Still one would have to cite this as an example of a cluster, albeit not a totally complementary cluster.

A pattern that is emerging is one where technological innovation protected by patents and copyrights, develops in the United States. Then as elements of the finished manufactured product achieves a commodity status it is a candidate for manufacture in lower wage countries. The products are then produced abroad imported into U.S. markets (and throughout the world) with royalty payments, and or other service fees paid to the U.S. companies that began the process. The commodity balance of payments continues to deteriorate for the U.S. where a new record imbalance in the balance of payments occurs almost every month. Still, the dollar remains strong because the companies that gain the surplus produced from the technological advances are U.S. based. Also the U.S. services producing industries, financials, communications, transportation, etc. with increasingly global markets are gaining market share as the global manufacturing system spreads out.

Another type of cluster is also seen in a high tech combination with aviation. The biotech cluster. In this case, exports of Biological Products, and Prepared Diagnostic Substances, both show steady sizable increases.

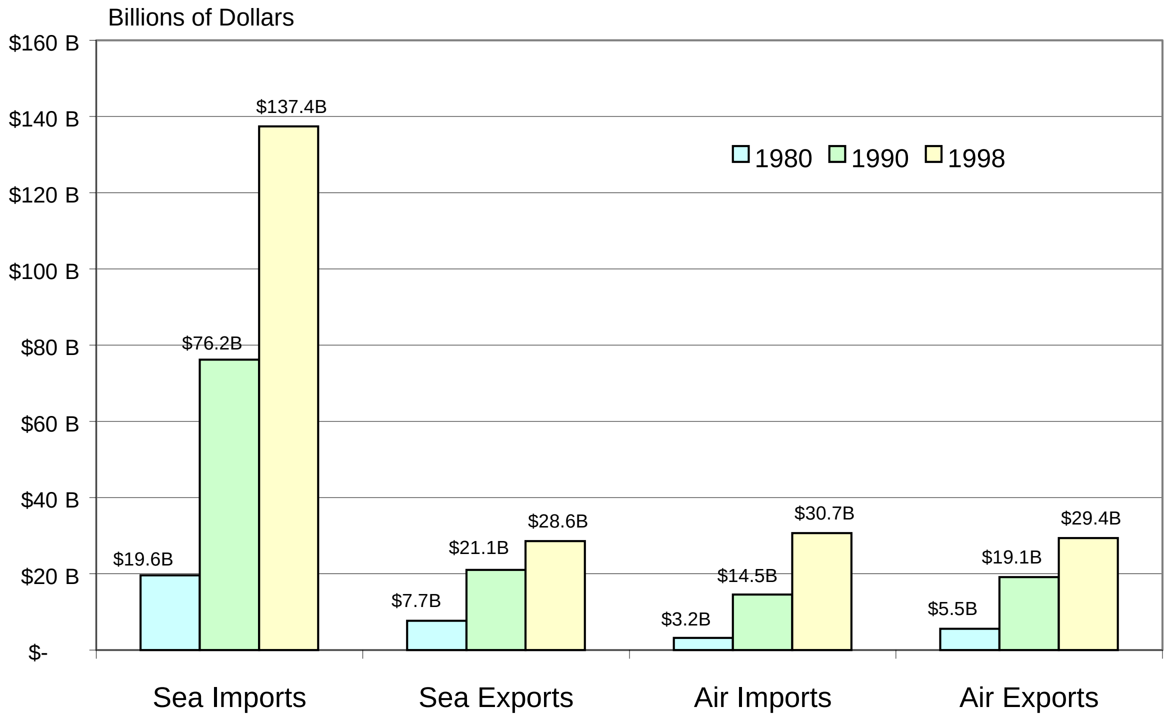
REGIONAL EXPORTS AND IMPORTS

Although the physical amount exported overseas out of Southern California by sea is substantially greater than the physical amount airfreighted, the value of those shipments are comparable. In 1998 over 26 million tons of commodities valued at $28.6 billion were exported by sea from Southern California while 285 thousand tons values at $29.4 billion were exported by air. Figure C-1 indicates that the value of exports by air has increased substantially since 1980 growing at an average of 10% per year. This was a faster growth rate than exports by sea which increased at 8% per year. The value of imports by air also increased at a great rate, increasing at an annual rate of 13% per year compared to 11% in for Sea Imports. The value of imports by air in 1998 almost matched air exports ($30.7 billion). This is in contrast to the value of exports by ship in 1998 which was only one fifth that of imports ($137.4 billion).

Figure C-1

VALUE OF EXPORTS/IMPORTS

FROM SOUTHERN CALIFORNIA BY MODE OF SHIPPING



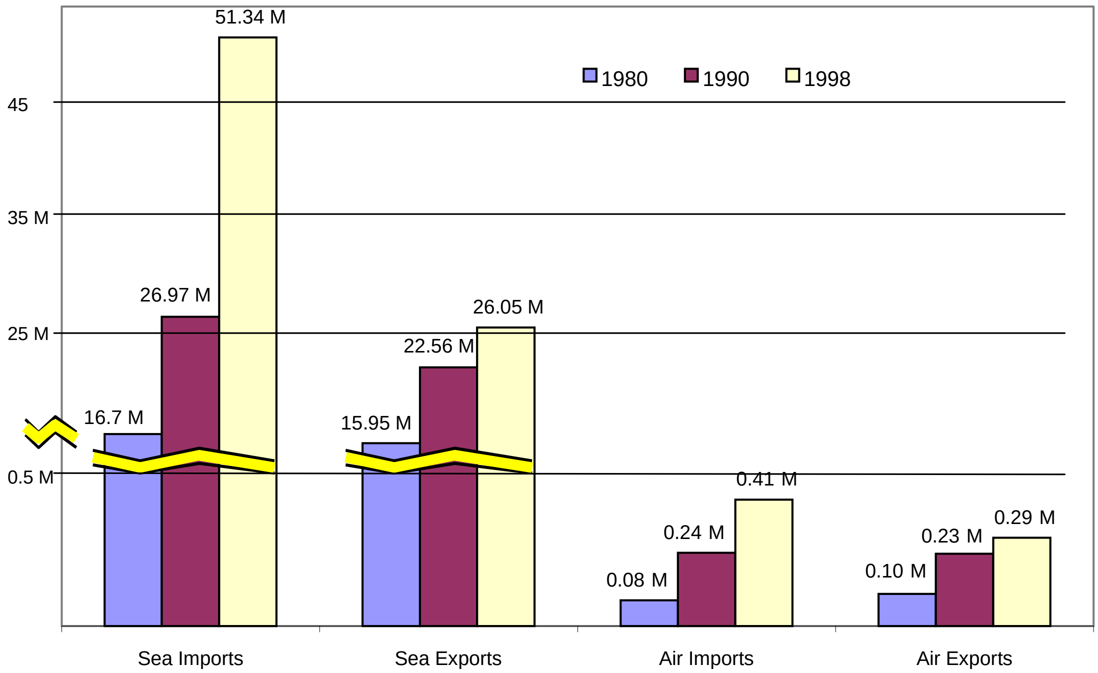
	Sea Imports	Sea Exports	Air Imports	Air Exports
Avg Ann. % Chg (1980-1990)	15%	11%	16%	13%
Avg Ann. % Chg (1990-1998)	8%	4%	10%	6%
Avg Ann. % Chg (1980-1998)	11%	8%	13%	10%

As stated earlier, the physical amount of shipments, measured as weight, between sea-borne and air-borne modes of shipment, are practically incomparable. Figure C-2 indicates the differences between the two methods of shipping. The lower growth rates in for mass of commodities both exported and imported is indicative of the role of inflation in increasing the value of imports and exports. A noticeable exception is the imports by sea going vessels during the 1990 to 1998 period where both weight and value rose by 8%. This is probably due to decreases in oil prices negating any increase in the value of other commodities.

Figure C-2

WEIGHT OF EXPORTS/IMPORTS

FROM SOUTHERN CALIFORNIA BY MODE OF SHIPPING



	Sea Imports	Sea Exports	Air Imports	Air Exports
Avg Ann. % Chg (1980-1990)	5%	4%	11%	8%
Avg Ann. % Chg (1990-1998)	8%	2%	7%	3%
Avg Ann. % Chg (1980-1998)	6%	3%	9%	6%

Electrical and electronic equipment and supplies is the category that accounts for the most value of imports and exports by air. Nearly 36 percent of the total value of imports and exports by air are in that category. The electrical and electronic equipment and supplies category was also the category of the greatest value of imports by ship accounting for 17 percent of all waterborne imports. However, the value of in the chemical and allied products made up the largest export category accounting 19 percent of the value of all waterborne exports. The following detailed tables list the value of commodities exported and imported for air into the area and the United States as a whole. In addition, detail tables of the weight of commodities exported and imported are also included.

Table C-3
Top 50 U.S. Air Cargo Exports By Industry
Ranked For Los Angeles Customs District (1998)

			Total U.S.		Los Angeles Customs District	
Rank	SIC	SIC Description	Value (Mil. $)	Weight (000 Lbs.)	Value (Mil. $)	Weight (000 Lbs.)
1	2752	PRINTED MATTER, LITHOGRAPHIC	$5,939.7	18,681	$514.1	1,258
2	2821	PLASTICS MATERIALS AND RESINS	$1,472.4	23,550	$495.6	4,312
3	2835	PREPARED DIAGNOSTIC SUBSTANCES	$4,145.7	66,030	$356.1	5,226
4	2836	BIOLOGICAL PRODUCTS	$2,621.7	30,408	$349.1	4,158
5	3089	PLASTICS PRODUCTS, NSPF	$2,598.5	50,763	$305.4	6,506
6	3339	PRIMARY NONFERROUS METALS, NSPF	$3,338.1	39,687	$288.4	3,356
7	3357	NONFERROUS METAL WIRE & CABLE, DR	$570.4	28,969	$235.4	8,566
8	3494	VALVES AND PIPE FITTINGS, NSPF	$1,518.2	27,385	$176.4	2,689
9	3499	FABRICATED METAL PRODUCTS, NSPF	$1,930.1	45,282	$173.4	4,001
10	3511	TURBINES AND TURBINE GENERATOR SE	$1,553.5	26,116	$161.6	2,203
11	3533	OIL AND GAS FIELD EQUIPMENT, AND	$1,946.9	98,843	$136.8	6,212
12	3541	MACHINE TOOLS, METAL-CUTTING, AND	$639.4	5,673	$128.7	900
13	3559	SPECIAL INDUSTRY MACHINERY, NSPF,	$789.7	60,168	$91.0	7,477
14	3569	GENERAL INDUST MACH & EQUIPMENT &	$471.5	9,795	$84.2	1,931
15	3571	ELECTRONIC COMPUTERS	$901.1	61,767	$84.1	6,174
16	3572	COMPUTER STORAGE DEVICES	$633.6	21,578	$82.8	2,288
17	3577	COMPUTER PERIPHERAL EQUIP NSPF &	$1,216.2	10,093	$81.7	973
18	3579	OFFICE MACHINES, NSPF, AND PARTS,	$702.2	15,477	$74.1	1,417
19	3599	MACHINERY, EXC ELECTRICAL, NSPF A	$252.1	12,435	$73.5	2,825
20	3625	RELAYS AND INDUSTRIAL CONTROLS	$724.7	12,168	$66.2	1,081
21	3643	CURRENT-CARRYING WIRING DEVICES	$360.7	77,129	$65.5	14,200
22	3651	RADIO/TV RECV SETS; PHONOGRAPHS;	$689.0	50,686	$62.0	2,334
23	3652	PHONOGRAPH RECRDS, RECRD BLANKS &	$282.5	12,261	$60.3	1,698
24	3661	TELEPHONE AND TELEGRAPH APPARATUS	$632.8	6,725	$54.8	497
25	3663	RADIO, TV COMMUN, BRDCST & STUDIO	$403.3	18,503	$53.7	2,019
26	3672	PRINTED CIRCUIT BOARDS	$230.9	8,017	$49.9	1,870
27	3674	SEMICONDUCTORS AND RELATED DEVICE	$548.2	21,339	$49.5	988
28	3678	CONNECTORS, FOR ELECTRONIC APPLIC	$126.4	17,095	$46.1	5,379
29	3679	ELECTRONIC COMPONENTS, NSPF	$648.6	21,618	$45.3	2,189
30	3695	MAGNETIC RECORDING MEDIA	$489.7	21,627	$43.2	1,238
31	3699	ELECTRICAL EQUIP & SUPPLIES, NSPF	$427.4	5,850	$42.7	241
32	3714	MOTOR VEHICLE PARTS AND ACCESSORI	$44.9	29	$40.5	15
33	3721	AIRCRAFT	$196.0	19,863	$40.4	3,152
34	3724	AIRCRAFT ENGINES AND ENGINE PARTS	$2,961.7	986	$40.1	82
35	3728	AIRCRAFT EQUIPMENT, NSPF	$607.7	54,970	$39.3	2,783
36	3812	SEARCH, DETECTN, NAVIG & GUIDANCE	$1,270.4	67,206	$34.6	3,301
37	3823	INDUSTRIAL INSTRUMENTS F MEASUREM	$128.1	8,790	$32.6	1,927
38	3825	INSTRUMTS F MEASURG & TESTG ELEC	$299.7	7,890	$32.3	834
39	3826	LABORATORY ANALYTICAL INSTRUMENTS	$162.6	11,180	$32.2	2,384
40	3827	OPTICAL INSTRUMENTS, AND PARTS, N	$251.5	11,247	$31.1	993
41	3829	MEASURING & CONTROLLING DEVICES N	$499.6	39,376	$31.0	1,813
42	3841	SURGICAL & MEDICAL INSTRUMENTS &	$697.4	20,227	$30.9	970
43	3842	ORTHOPEDIC, PROSTHETIC & SURGICL	$155.2	27,553	$30.4	6,375
44	3843	DENTAL EQUIPMENT, SUPPLIES, AND P	$204.9	20,077	$28.8	2,435
45	3844	X-RAY APPARATUS AND TUBES, AND PA	$309.9	11,981	$27.9	826
46	3845	ELECTROMEDICAL & ELECTROTHERAPEUT	$291.9	8,577	$27.3	747
47	3861	PHOTOGRAPHIC EQUIPMENT AND SUPPLI	$193.7	8,023	$26.6	489
48	3949	SPORTING AND ATHLETIC GOODS, AND	$184.6	23,045	$24.6	1,850
49	3XXX	MANUFACTURED COMMODITIES NOT IDEN	$173.8	6,468	$23.3	679
50	9200	USED OR SECOND-HAND MERCHANDISE	$251.5	10,713	$23.3	781
		Sub-Total 50 Industries	$47,689.9	1,283,917	$5,128.7	138,643
		Sub-Total Next 50 Industries	$169,893.2	4,380,240	$26,732.0	462,230
		Total - Top 100 Industries	$217,583.1	5,664,157	$31,860.7	600,873

Source: U.S. Department of Commerce, Customs Agency (1998)

Table C-4
Top 50 U.S. Air Cargo Imports By Industry Ranked For Los Angeles Customs District (1998)

Rank	SIC	SIC Description	Total U.S. Value (Mil. $)	Total U.S. Weight (000 Lbs.)	Los Angeles Customs District Value (Mil. $)	Los Angeles Customs District Weight (000 Lbs.)
1	3572	COMPUTER STORAGE DEVICES, AND PAR	$16,262.0	193,782	$5,670.7	73,141
2	3674	SEMICONDUCTORS & RELATED DEVICES,	$29,041.3	125,874	$4,851.7	28,705
3	3571	COMPUTERS, AND PARTS, NSPF	$26,850.2	330,186	$4,800.1	66,542
4	9800	U.S. GDS RET & REIMPTD ART, DTY P	$12,912.0	137,656	$1,158.0	11,972
5	3339	PRIMARY NONFERROUS METALS, NSPF	$4,471.2	5,126	$909.0	554
6	3663	RADIO, BROADCAST & TV COMMUNICATI	$4,272.5	52,541	$779.0	9,999
7	3724	AIRCRAFT ENGINES AND ENGINE PARTS	$8,556.3	38,753	$626.6	2,884
8	3679	ELECTRONIC COMPONENTS, NSPF	$4,862.4	123,635	$604.6	19,160
9	3911	JEWELRY, OF PRECIOUS METAL	$3,958.8	8,352	$576.7	770
10	3577	COMPUTER PERIPHERAL EQUIP, NSPF A	$2,307.9	73,296	$531.0	15,892
11	3861	PHOTOGRAPHIC EQUIPMENT AND SUPPLI	$2,239.0	61,322	$385.0	9,649
12	3672	PRINTED CIRCUIT BOARDS	$1,705.6	38,024	$376.3	7,249
13	2833	MEDICINALS AND BOTANICALS	$7,189.5	22,291	$339.7	1,216
14	3651	RADIO & TV REC SETS, PHONOGRPH, R	$1,621.2	61,669	$295.2	15,770
15	3661	TELEPHONE AND TELEGRAPH APPARATUS	$3,304.7	93,795	$294.1	11,202
16	3873	WATCHES, CLOCKS, CLOCKWORK OPER D	$2,223.5	32,140	$283.0	3,428
17	3915	JEWELERS' FINDINGS & MATERIALS, &	$8,823.7	2,755	$268.8	354
18	2369	CHILDREN'S OUTERWEAR, NSPF	$2,250.0	210,094	$236.7	25,015
19	9200	USED OR SECOND-HAND MERCHANDISE	$3,237.7	21,125	$229.9	1,819
20	3944	GAMES, TOYS & CHILDREN'S VEH EXC	$1,320.0	74,685	$229.5	15,383
21	9900	SPECIAL CLASSIFICATION PROVISIONS	$804.1	20,725	$217.9	3,122
22	3825	INSTRMTS F MEASURING & TSTNG ELEC	$2,021.6	23,842	$210.1	2,591
23	3559	SPECIAL INDUSTRY MACHINERY, NSPF,	$1,207.2	29,880	$185.8	4,617
24	3728	AIRCRAFT EQUIPMENT, NSPF	$1,925.7	16,716	$173.0	2,013
25	3827	OPTICAL INSTRUMENTS, AND PARTS, N	$1,385.0	19,478	$169.9	3,381
26	3695	RECORDING MEDIA	$387.4	14,326	$153.2	4,094
27	3677	ELECTRONIC COILS AND TRANSFORMERS	$539.1	13,538	$145.8	3,562
28	3579	OFFICE MACHINES, NSPF, AND PARTS,	$442.1	14,253	$143.2	3,225
29	2331	WOMEN'S AND MISSES' BLOUSES AND S	$1,262.6	98,738	$142.1	11,522
30	2321	MEN'S AND BOY'S SHIRTS	$1,066.5	119,919	$137.4	16,614
31	3851	OPHTHALMIC GOODS, AND PARTS, NSPF	$1,252.8	23,101	$126.0	2,989
32	2221	BROAD WOVEN FABRICS, MAN-MADE FIB	$595.2	44,329	$119.1	10,180
33	3652	PHONO REC; PRE-RECRD MGNTC TPS O	$619.1	31,490	$117.4	4,633
34	3949	SPORTING AND ATHLETIC GOODS, AND	$433.2	39,743	$113.3	9,454
35	3714	MOTOR VEHICLE PARTS AND ACCESSORI	$1,325.7	194,879	$112.9	10,261
36	3691	STORAGE BATTERIES, AND PARTS, NSP	$428.5	16,251	$110.9	3,323
37	3699	ELECTRCL EQUIP & SUPPLIES, NSPF A	$1,015.8	22,983	$107.5	2,681
38	3625	RELAYS AND INDUSTRIAL CONTROLS, A	$1,136.0	43,188	$106.4	3,433
39	3499	FABRICATED METAL PRODUCTS, NSPF	$650.7	34,868	$100.2	3,608
40	2335	WOMEN'S AND MISSES' DRESSES	$705.3	49,729	$94.8	8,017
41	3812	NAVIGATION, AERONAUTICAL, ETC. SY	$735.4	5,806	$94.8	799
42	3356	EXTRUDED NONFERROUS MET MLL PRODS	$671.9	4,635	$90.1	443
43	3675	ELECTRONIC CAPACITORS	$703.7	13,570	$89.2	2,460
44	3357	NONFERROUS METL WIRE & CABLE, DRA	$659.4	38,709	$85.8	7,343
45	2836	BIOLOGICAL PRODUCTS	$799.5	4,632	$83.1	687
46	3942	DOLLS AND STUFFED TOY ANIMALS	$198.2	32,152	$80.5	14,293
47	3578	CALCULATING & ACCOUNTING MACH, AN	$296.7	10,797	$79.8	1,771
48	3569	GENERAL INDUST MACHINERY & EQUIP,	$1,054.4	41,081	$76.6	3,330
49	2869	INDUSTRIAL ORGANIC CHEMICALS, NSP	$2,704.3	37,149	$74.8	1,938
50	3999	MANUFACTURED ARTICLES, NSPF	$452.9	37,515	$73.8	6,081
		Sub-Total Top 50 Imports	$174,889.7	2,805,122	$27,061.3	473,172
		Sub-Total Next 50 Imports	$49,592.6	3,765,913	$3,574.9	341,339
		Total - Top 100 Imports	$224,482.3	6,571,035	$30,636.2	814,511

Source: U.S. Department of Commerce, Customs Agency (1998)

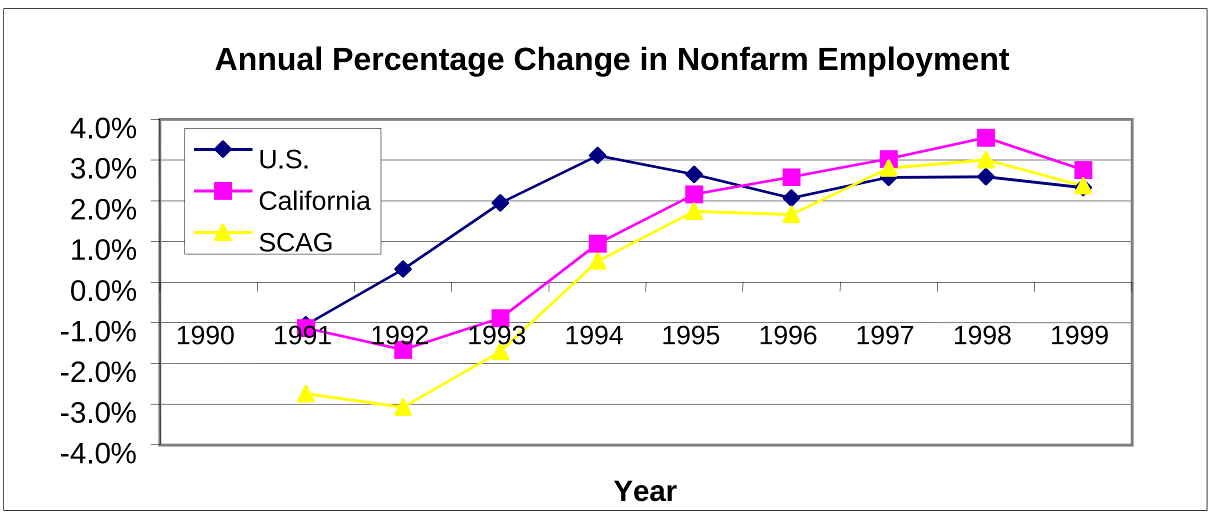
APPENDIX D

SCAG REGION ECONOMIC SHARE ANALYSIS

REGIONAL ECONOMIC BACKGROUND INFORMATION

The last decade of the twentieth century has been a period of dynamic change in the economy of the United States. Nowhere has this been more evident than in the State of California, and in particular Southern California. Downsizing the military, and cuts in defense spending in the early 1990s hit this area very hard. Still, underlying these severe contractions, was a robust economy in the making, an economy that was increasingly focused on international trade in goods and services. However, while employment growth rates turned positive in the U.S. in 1992, it took California and the SCAG region until 1994 to begin increasing. After 1996, California and the SCAG region began to outperform the country as a whole.

Figure D-1



That aviation has played an important role in the transformation of the U.S. economy and in particular the California and SCAG region economy is quite evident from the data.

Therefore, before discussing the 2020 SCAG regional economy, it is informative to examine some of the key elements of economic change that have occurred in the last decade.

The remarkable growth in the U.S. economy included all sectors except mining, where increasingly the U.S. is relying on imports to meet growing demand. This was and is also the case with manufacturing, where while manufacturing output increased at a robust 4.8 percent annual average rate, employment in manufacturing actually declined. Increasingly manufacturing is finding its way to lower cost countries. Aviation is playing an important part in this through movement of business personnel between countries, and the movement of cargo.

Some remarkable changes occurred in Agriculture where total value added increased at a very high 8.2 percent while the value of output was increasing at a much lower 1.6 percent. The reason for this is shown in the component parts of value added. Proprietor earnings declined by 4.9 percent while employee compensation other property income (mostly corporate profits) increased an annual average of 5.7 percent and nearly 200 percent respectively. This burgeoning corporate farming sector and declining family farming was also the source of rapid increases in indirect business taxes.

Table D-1

UNITED STATES AVERAGE ANNUAL PERCENTAGE CHANGE IN OUTPUT, VALUE ADDED AND EMPLOYMENT, 1990 TO 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	1.6%	0.8%	5.7%	-4.3%	198.9%	23.3%	8.2%
Mining	-7.6%	-2.6%	0.0%	5.4%	-9.0%	-12.0%	-7.9%
Construction	2.1%	0.9%	3.4%	10.2%	0.4%	13.1%	4.4%
Manufacturing	4.8%	-0.5%	3.9%	32.1%	-0.3%	5.9%	2.9%
TCPU	7.9%	1.6%	5.4%	18.8%	5.4%	15.0%	6.7%
Trade	10.5%	1.8%	5.3%	9.3%	43.8%	11.8%	9.6%
FIRE	9.7%	1.6%	6.5%	51.7%	10.5%	2.3%	8.5%
Services	8.5%	4.1%	8.5%	3.5%	12.3%	13.4%	8.0%
Government	7.9%	1.5%	5.4%	0.0%	80.3%	0.0%	8.1%
Other	10.0%	-1.7%	0.4%	0.0%	26.0%	0.0%	10.0%
Totals	6.5%	1.8%	5.6%	7.3%	8.0%	6.1%	6.4%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

These patterns generally held for the SCAG region, although much more pronounced. Some of the more remarkable percentage changes in the region are due to the tyranny of small numbers. For example in agriculture 1990 "other property income" was actually negative, which makes the average percentage change difficult to express.

Table D-2

SCAG REGION AVERAGE ANNUAL CHANGE IN OUTPUT, VALUE ADDED AND EMPLOYMENT, 1990 TO 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	1.6%	-0.2%	1.6%	-5.7%	n.a.	84.5%	5.6%
Mining	-8.2%	10.5%	7.3%	-5.2%	-10.1%	-10.1%	-8.2%
Construction	-3.1%	-4.0%	-4.0%	4.8%	-2.8%	24.3%	-2.2%
Manufacturing	0.7%	-3.1%	-1.3%	15.2%	-6.1%	9.5%	-2.4%
TCPU	9.1%	1.4%	2.5%	16.9%	4.1%	31.1%	5.2%
Trade	6.8%	0.2%	0.4%	11.3%	37.7%	7.1%	4.7%
FIRE	7.9%	-1.2%	-0.9%	53.0%	8.6%	5.3%	6.2%
Services	7.0%	2.7%	2.4%	3.5%	9.6%	22.4%	3.6%
Government	-3.7%	-8.5%	-5.5%	0.0%	35.4%	0.0%	-4.1%
Other	-0.7%	3.3%	6.8%	0.0%	-15.3%	0.0%	-0.7%
Totals	3.4%	-1.7%	-1.0%	6.8%	5.4%	7.9%	1.6%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

The primary difference between the U.S. and California and the SCAG region is in the Government sector. Nationwide, government employment was increasing at an average annual rate of 1.5 percent while in the SCAG region, it was declining at a rate of -8.5 percent. Table 18 shows the dramatic changes in absolute terms. The negative million-job change in government employment was mostly military base closure related. And the 235,638 decrease in manufacturing jobs was mainly in defense related industries. The peace dividend was costly to the Southern California economy. The decline in the construction industry was in response to the general decline related to the military and defense related decreases. When vacancy rates go up, construction spending goes down.

Table D-3

SCAG REGION CHANGE IN OUTPUT, VALUE ADDED AND EMPLOYMENT, 1990 TO 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	$568.3	-1,989	$151.5	-$492.8	$1,207.2	$111.8	$977.8
Mining	-$3,623.5	7,075	$236.2	-$50.9	-$2,457.6	-$359.4	-$2,631.6
Construction	-$8,853.3	-132,424	-$3,565.8	$992.4	-$184.5	$178.3	-$2,579.5
Manufacturing	$7,026.9	-235,638	-$3,799.6	$1,329.3	-$9,460.9	$817.5	-$11,113.7
TCPU	$20,169.4	26,455	$1,841.3	$1,393.0	$2,271.5	$1,973.8	$7,479.7
Trade	$30,548.1	21,449	$977.1	$1,872.1	$8,844.3	$4,502.7	$16,196.2
FIRE	$47,874.8	-47,098	-$1,053.8	$2,878.3	$23,390.6	$3,623.7	$28,838.8
Services	$54,544.6	398,459	$9,664.0	$3,466.7	$4,776.3	$1,819.1	$19,726.1
Government	-$15,524.2	-1,015,129	-$20,643.8	$0.0	$4,722.2	-$4.3	-$15,925.9
Other	-$55.8	21,149	$365.0	$0.0	-$420.8	$0.0	-$55.8
Totals	$132,675.2	-957,690	-$15,827.7	$11,388.1	$32,688.3	$12,663.4	$40,912.0

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

* Dollar amounts in $millions.

Shift Share Analysis

A method of measurement of regional economic change that avoids the tyranny of small numbers is called shift share analysis. This method defines the region in terms of its share of an area that contains that region, for example the SCAG region as a part or share of the State of California or of the United States as a whole. By computing the difference in the share at different times, a measure is taken of the change in the region relative to the state or U.S. For example, Table D-4 and D-5 illustrate the same type of information that was presented in Table D-3 for the SCAG region as reflected in “shares” of the California economy in 1990 and 1996 respectively. Table D-6 indicates the “shift” in shares between the years 1990 and 1996.

Table D-4

SCAG REGION SHARE OF CALIFORNIA OUTPUT, VALUE ADDED AND EMPLOYMENT (1990)

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	24.3%	22.9%	26.6%	19.1%	25.2%	16.4%	22.2%
Mining	32.8%	37.1%	38.4%	40.5%	34.0%	41.4%	35.3%
Construction	45.7%	45.7%	45.6%	45.7%	45.8%	45.9%	45.6%
Manufacturing	53.9%	57.9%	54.8%	60.0%	54.9%	40.9%	54.6%
TCPU	45.4%	48.9%	47.8%	50.7%	45.8%	44.8%	47.0%
Trade	52.6%	50.5%	53.1%	50.5%	50.8%	52.7%	52.7%
FIRE	52.1%	50.4%	53.3%	52.1%	51.9%	49.9%	51.9%
Services	53.8%	51.2%	54.0%	52.3%	55.3%	51.5%	53.8%
Government	41.1%	39.8%	39.7%	0.0%	63.2%	51.6%	40.3%
Other	55.1%	59.7%	59.7%	0.0%	47.9%	0.0%	55.1%
Totals	49.7%	47.6%	48.8%	47.2%	51.3%	49.9%	49.3%

Source: CIC Research, 1999. Derived from IMPLAN 1990 data.

Just looking at the 1996 share information (Table D-5) indicates that the SCAG region is about half of the California economy by most measures. However, the share declines between 1990 and 1996. The decline is best examined by looking at the "Shift" Table D-8. Table D-8 shows clearly that the SCAG Region was losing ground to the rest of California from 1990 to 1996 in virtually every sector except Transportation, Communications, and Public Utilities and Mining. The mining change is actually related to an in region shift from relatively high value to low value (sand and gravel) mining. This was due to a ramp up in road construction, which partially offset a severely depressed construction sector.

Table D-5

SCAG REGION SHARE OF CALIFORNIA OUTPUT, VALUE ADDED AND EMPLOYMENT, 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	19.0%	20.7%	21.3%	18.8%	17.3%	16.9%	19.3%
Mining	45.4%	44.6%	45.1%	39.9%	48.5%	46.9%	46.9%
Construction	44.1%	44.4%	43.7%	44.7%	42.5%	43.3%	43.9%
Manufacturing	47.7%	53.9%	47.7%	57.0%	41.2%	41.7%	46.0%
TCPU	46.8%	49.1%	48.8%	47.5%	44.8%	43.1%	46.5%
Trade	50.2%	48.5%	50.2%	48.6%	50.6%	50.6%	50.2%
FIRE	49.9%	48.4%	49.5%	50.1%	50.1%	50.6%	50.0%
Services	51.0%	49.4%	50.3%	50.0%	54.4%	52.4%	50.7%
Government	41.0%	39.9%	40.4%	0.0%	36.2%	0.0%	39.7%
Other	61.1%	57.6%	61.7%	0.0%	47.0%	0.0%	61.1%
Totals	47.8%	47.0%	47.0%	47.5%	47.0%	49.1%	47.2%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

Table D-6

SHIFT IN SHARE OF OUTPUT, VALUE ADDED AND EMPLOYMENT FOR THE SCAG REGION COMPARED TO CALIFORNIA 1990 TO 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	-5.3%	-2.2%	-5.2%	-0.2%	-7.8%	0.4%	-3.0%
Mining	12.7%	7.5%	6.7%	-0.6%	14.4%	5.5%	11.6%
Construction	-1.7%	-1.3%	-1.9%	-1.0%	-3.2%	-2.6%	-1.7%
Manufacturing	-6.2%	-4.0%	-7.1%	-3.0%	-13.7%	0.8%	-8.6%
TCPU	1.4%	0.2%	1.0%	-3.2%	-1.1%	-1.7%	-0.5%
Trade	-2.4%	-2.0%	-2.9%	-1.8%	-0.2%	-2.2%	-2.5%
FIRE	-2.2%	-2.0%	-3.9%	-2.0%	-1.8%	0.7%	-1.9%
Services	-2.8%	-1.9%	-3.8%	-2.3%	-0.9%	1.0%	-3.0%
Government	-0.1%	0.1%	0.6%	0.0%	-27.0%	-51.6%	-0.5%
Other	6.1%	-2.1%	2.0%	0.0%	-0.8%	0.0%	6.1%
Totals	-1.9%	-0.6%	-1.7%	0.3%	-4.3%	-0.8%	-2.1%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

The negative share changes for the SCAG region relative to California are illustrated best by looking and the changes that were taking place throughout California relative to the U.S. economy as a whole. Table D-7 shows these dramatic changes in the California economy. The only sector gaining ground on the U.S. economy in California was Agriculture. Everything else was negative.

Table D-7

SHIFT IN SHARE OF OUTPUT, VALUE ADDED AND EMPLOYMENT FOR CALIFORNIA COMPARED TO THE U.S. 1990 TO 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	2.8%	0.5%	0.5%	-1.6%	23.9%	6.7%	0.5%
Mining	-2.5%	2.1%	1.0%	-3.6%	-3.7%	0.9%	-2.1%
Construction	-3.5%	-3.4%	-5.1%	-3.0%	-1.5%	3.2%	-4.3%
Manufacturing	-1.0%	-1.1%	-1.8%	-4.6%	-1.6%	1.3%	-1.7%
TCPU	0.2%	-0.2%	-1.9%	0.1%	-0.4%	4.1%	-0.6%
Trade	-1.3%	-0.6%	-2.6%	2.0%	-1.3%	-1.8%	-2.1%
FIRE	-0.4%	-1.6%	-4.1%	1.0%	-0.6%	2.0%	-0.9%
Services	-0.2%	-0.4%	-3.1%	0.8%	-1.4%	3.3%	-2.2%
Government	-11.0%	-13.5%	-12.3%	0.0%	-0.9%	0.0%	-11.7%
Other	-7.8%	4.9%	5.4%	0.0%	-17.1%	0.0%	-7.8%
Totals	-1.3%	-2.6%	-4.5%	-0.5%	-0.3%	1.2%	-2.7%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

By comparison, the shifts in the SCAG region relative to the U.S. economy as a whole appear relatively more modest (Table D-8). However, this is because the share measures are half those of California. Table D-6 already demonstrated that SCAG regional economy was losing share of the California economy as a whole.

Table D-8

SHIFT IN SHARE OF OUTPUT, VALUE ADDED AND EMPLOYMENT FOR THE SCAG REGION COMPARED TO THE U.S 1990 TO 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Agriculture	0.0%	-0.2%	-1.1%	-0.3%	4.9%	1.1%	-0.4%
Mining	-0.2%	1.2%	0.8%	-1.5%	-0.4%	0.6%	-0.1%
Construction	-1.8%	-1.7%	-2.5%	-1.5%	-1.0%	1.2%	-2.1%
Manufacturing	-1.1%	-1.0%	-1.8%	-3.1%	-2.3%	0.6%	-1.8%
TCPU	0.3%	-0.1%	-0.8%	-0.4%	-0.3%	1.6%	-0.3%
Trade	-1.0%	-0.5%	-1.7%	0.7%	-0.7%	-1.2%	-1.4%
FIRE	-0.5%	-1.0%	-2.6%	0.2%	-0.6%	1.1%	-0.8%
Services	-0.5%	-0.4%	-2.2%	0.0%	-0.9%	1.8%	-1.6%
Government	-4.5%	-5.4%	-4.8%	0.0%	-4.3%	-6.9%	-4.8%
Other	-3.7%	2.6%	3.7%	0.0%	-8.2%	0.0%	-3.7%
Totals	-0.9%	-1.3%	-2.4%	-0.2%	-0.7%	0.5%	-1.6%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

Changes in the Transportation Industries

The transportation sector of California was impacted by the same changes that rocked the state's economy in general. However, the underlying strength of the economy, agriculture, and manufactured goods that account for the bulk of U.S. exports and imports provided a growing base that fueled the recovery. The only state transportation sector that increased relative to the U.S. as a whole was Pipelines except natural gas. This only because this sector declined in the U.S. while managing a very small gain in California. However, overall, the California transportation sector grew only slightly less (0.6%) than the U.S. as a whole. Moreover, the SCAG transportation sectors also grew at only a slightly lower (0.3%) rate than the U.S. as a whole, and Water transportation grew faster than the U.S.

Table D-9

CHANGE IN OUTPUT, VALUE ADDED AND EMPLOYMENT, CALIFORNIA 1990 – 1996

*Millions of dollars

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Railroads and Related Services	$648.3	-5,458	-$93.8	-$5.0	$436.8	-$1.1	$336.9
Local, Interurban Passenger Transit	$670.6	10,811	$299.7	$100.7	$71.7	$8.4	$480.5
Motor Freight Transport and Warehousing	$7,860.2	5,554	$500.8	$237.2	-$301.0	$143.5	$580.5
Water Transportation	$2,499.3	-1,068	$275.7	$17.0	$444.6	$122.7	$859.9
Air Transportation	$5,563.9	35,189	$1,513.3	$136.2	$1,294.0	-$14.8	$2,928.7
Pipe Lines, Except Natural Gas	$19.7	45	$31.4	$0.0	-$154.9	$30.0	-$93.6
Arrangement Of Passenger Transportation	$565.1	3,002	$188.4	$26.8	$322.3	$39.0	$576.5
Transportation Services	$2,300.2	10,294	$432.9	$49.3	$436.6	$23.2	$942.1
Total	$20,127.2	58,370	$3,148.4	$562.3	$2,550.0	$350.8	$6,611.5

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

Table D-10

SHIFT IN SHARE OF OUTPUT, VALUE ADDED AND EMPLOYMENT FOR CALIFORNIA COMPARED TO THE U.S. 1990 –1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Railroads and Related Services	-0.9%	-0.7%	-1.0%	0.0%	-0.8%	0.6%	-0.9%
Local, Interurban Passenger Transit	0.0%	0.0%	-0.4%	2.8%	-0.1%	4.0%	0.0%
Motor Freight Transport and Warehousing	-0.7%	-0.2%	-1.2%	0.0%	-0.3%	3.2%	-0.7%
Water Transportation	-0.1%	0.0%	0.2%	-12.7%	0.7%	4.0%	0.4%
Air Transportation	-1.5%	-1.2%	-2.2%	13.7%	-1.4%	0.6%	-1.6%
Pipe Lines, Except Natural Gas	2.7%	2.9%	2.6%	0.0%	2.9%	4.2%	2.9%
Arrangement Of Passenger Transportation	-2.4%	-0.6%	-2.0%	-13.7%	-0.7%	0.3%	-3.1%
Transportation Services	-2.3%	0.8%	-1.4%	-17.2%	-0.2%	1.8%	-4.2%
Total	-0.6%	-0.1%	-1.0%	-0.7%	1.3%	2.3%	-0.4%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

Table D-11

CHANGE IN OUTPUT, VALUE ADDED AND EMPLOYMENT, SCAG REGION 1990 – 1996

*Millions of dollars

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Railroads and Related Services	$480.6	-1,303	$36.5	-$0.2	$233.2	$4.8	$274.2
Local, Interurban Passenger Transit	$258.0	3,164	$111.5	$44.5	$29.1	$3.1	$188.2
Motor Freight Transport and Warehousing	$3,201.7	-3,322	$58.9	$73.4	-$200.9	$59.5	-$9.1
Water Transportation	$1,570.4	625	$235.6	$8.4	$257.6	$76.5	$578.0
Air Transportation	$3,109.7	20,103	$931.4	$72.5	$668.6	$2.2	$1,674.7
Pipe Lines, Except Natural Gas	-$219.9	-120	-$1.8	$0.0	-$207.7	$7.5	-$202.1
Arrangement Of Passenger Transportation	$308.7	1,658	$95.9	$14.8	$178.1	$22.3	$311.1
Transportation Services	$1,421.7	6,830	$265.7	$33.8	$264.4	$14.1	$578.0
Total	$10,131.0	27,634	$1,733.7	$247.2	$1,222.3	$190.0	$3,393.1

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

Table D-12

SHIFT IN SHARE OF OUTPUT, VALUE ADDED AND EMPLOYMENT FOR THE SCAG REGION COMPARED TO THE U.S. 1990 – 1996

Industry	Industry Output*	Employment	Employee Compensation*	Proprietor Income*	Other Property Income*	Indirect Business Tax*	Total Value Added*
Railroads and Related Services	0.1%	0.2%	0.1%	0.0%	0.2%	0.8%	0.1%
Local, Interurban Passenger Transit	-0.4%	-0.5%	-0.6%	1.0%	-0.5%	1.5%	-0.4%
Motor Freight Transport and Warehousing	-0.6%	-0.4%	-0.9%	-0.3%	-0.5%	1.2%	-0.7%
Water Transportation	0.8%	0.6%	1.3%	-5.9%	1.6%	3.6%	1.4%
Air Transportation	-0.3%	-0.3%	-0.6%	7.3%	-0.2%	0.6%	-0.3%
Pipe Lines, Except Natural Gas	-0.5%	0.8%	-0.6%	0.0%	-0.4%	0.8%	-0.4%
Arrangement Of Passenger Transportation	-1.4%	-0.3%	-1.4%	-7.4%	-0.7%	0.5%	-1.9%
Transportation Services	-1.2%	0.8%	-0.8%	-10.0%	-0.1%	1.2%	-2.4%
Total	-0.3%	-0.1%	-0.4%	-0.6%	0.4%	1.3%	-0.2%

Source: CIC Research, 1999. Derived from IMPLAN 1996 data.

APPENDIX E

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

2020 REGIONAL TRANSPORTATION PLAN FORECAST SCENARIOS AND 2020 SCAG REGION ECONOMY

Table E-1
SCAG 2020 RTP FORECAST SCENARIOS

Scenarios	Description	Pt. Mugu	BUR	LAX	ONT	El Toro	John Wayne	LGB	PSP	PMD	SBD	SCI	March
RTP Baseline	With all airports unconstrained, what is demand in 2020?												
	Total Passengers	1,963,210	9,236,157	94,181,012	15,368,386	22,207,488	7,002,901	2,802,880	1,699,380	130,018	1,779,985	124,870	914,122
	Domestic	1,963,210	9,236,157	49,185,092	14,265,226	16,775,088	7,002,901	2,802,880	1,699,380	130,018	1,779,985	124,870	914,122
	Commuter	115,829	532,926	2,503,521	854,487	635,776	381,658	111,555	115,218	130,018	0	124,870	62,069
	Short	1,487,721	5,959,169	22,000,492	8,303,788	8,338,896	5,582,012	1,500,101	1,006,203	0	0		631,658
	Medium Long	314,310	2,215,754	11,602,763	4,106,959	5,376,416	962,199	783,125	371,994	0	1,779,985		155,492
	Long	45,350	528,308	13,078,316	999,992	2,424,000	77,032	408,099	205,965	0			64,903
	International	0	0	44,995,920	1,103,160	5,432,400	0	0	0	0			0
	Total Cargo (tons)	9,103.9	70,000.0	3,943,446.6	1,241,283.2	1,331,829.4	25,897.6	59,987.5	16,595.7	16,670.0	885,213.4	300,237.5	1,000,012.4
	Domestic (tons)	9,103.9	70,000.0	2,389,863.1	873,557.5	982,658.3	25,897.6	59,987.5	16,595.7	14,421.4	725,119.4	262,589.0	841,014.4
	International (tons)	0.0	0.0	1,553,583.5	367,725.7	349,171.1	0.0	0.0	0.0	2,248.6	160,094.0	37,648.4	158,997.9
2C	What effect does HSR have on Ontario and Inland Empire airports ability to meet future demand?		(6)	(1)		(1)		(2)					
	Total Passengers	3,029,210	9,410,017	70,000,014	26,098,354	28,800,102	9,399,177	3,000,161	1,793,787	1,157,177	1,306,690	465,721	1,628,542
	Domestic	3,029,210	9,410,017	32,270,916	22,876,283	21,338,357	9,399,177	3,000,161	1,793,787	1,157,177	1,306,690	465,721	1,628,542
	Commuter	204,472	531,666	577,649	363,733	452,373	385,366	90,305	93,098	69,315	49,132	55,840	61,233
	Short	2,230,104	5,751,402	12,798,645	7,981,535	7,724,485	6,950,692	1,680,390	1,116,273	1,018,431	1,126,497	409,881	1,384,424
	Medium Long	533,747	2,714,790	7,845,060	8,960,640	6,757,858	1,874,196	899,748	522,530	69,431	131,061	0	182,885
	Long	60,887	412,159	11,049,562	5,570,375	6,403,641	188,923	329,718	61,886	0		0	0
	International	0	0	37,729,098	3,222,071	7,461,745	0	0	0	0	0	0	0
	Total Cargo (tons)	212,044.7	67,752.1	2,590,000.5	2,087,868.3	1,699,206.0	24,437.7	63,003.4	14,170.9	114,902.4	770,947.1	263,132.4	993,411.2
	Domestic (tons)	193,525.1	67,752.1	1,428,553.3	1,404,642.1	1,223,232.8	24,437.7	63,003.4	14,170.9	101,567.9	630,497.9	230,367.4	836,594.2
	International (tons)	18,519.6		1,161,447.2	683,226.2	475,973.2				13,334.5	140,449.2	32,765.0	156,817.0
6	Can the existing airport system with current legal and physical constraints mee future demand?												
	Total Passengers		9,410,000	78,010,000	20,020,000	0	8,400,000	3,000,000	3,630,000	3,990,000	6,010,000	1,600,000	6,780,000
	Total Cargo (tons)												
8	What will the addition of El Toro have on Airport System's (with HSR) ability to meet future demand?		(6)	(7)			(7)	(2)					
	Total Passengers	0	9,410,106	78,007,709	25,576,851	25,102,356	8,400,133	3,000,104	2,235,243	1,398,475	1,456,451	608,365	1,273,642
	Domestic	0	9,410,106	37,609,499	22,665,841	19,511,226	8,400,133	3,000,104	2,235,243	1,398,475	1,456,451	608,365	1,273,642
	Commuter	0	375,463	1,335,137	614,244	684,844	251,164	90,303	171,220	77,056	58,404	89,916	49,799
	Short	0	5,201,907	14,870,796	10,940,802	8,922,484	7,074,592	1,597,555	1,450,449	839,085	964,607	482,555	982,743
	Medium Long	0	3,096,866	12,162,912	7,808,382	6,940,143	1,028,176	947,733	521,706	381,504	345,907	35,894	196,905
	Long	0	735,870	9,240,654	3,302,413	2,963,755	46,201	364,513	91,868	100,830	87,533	0	44,195
	International	0	0	40,398,210	2,911,010	5,591,130	0	0	0	0	0	0	0
	Total Cargo (tons)	0.0	73,398.8	2,974,426.2	2,046,148.0	1,506,141.2	25,200.4	63,002.2	17,881.9	119,989.1	801,047.5	291,278.5	982,385.1
	Domestic (tons)		73,398.8	1,760,361.2	1,394,991.5	1,100,557.5	25,200.4	63,002.2	17,881.9	105,585.2	655,245.8	255,225.8	826,490.4
	International (tons)	0.0	0.0	1,214,065.0	651,156.5	405,583.7	0.0	0.0	0.0	14,403.9	145,801.7	36,052.8	155,894.7
9	What effect would LAX Master Plan improvements have on Airport System (without El Toro) with HSR?		(6)				(7)	(2)					
	Total Passengers	0	9,410,105	86,401,224	33,797,873	0	8,400,104	3,000,109	3,013,846	1,223,546	2,882,547	1,199,847	5,489,961
	Domestic	0	9,410,105	41,195,004	28,309,613	0	8,400,104	3,000,109	3,013,846	1,223,546	2,882,547	1,199,847	5,489,961
	Commuter	0	375,463	1,767,266	880,429	0	252,843	89,703	180,529	55,549	115,590	107,746	219,049
	Short	0	5,399,518	14,702,497	12,660,059	0	4,722,538	1,583,158	1,676,000	981,039	2,177,765	969,597	3,396,090
	Medium Long	0	3,045,110	13,779,729	9,783,802	0	2,247,868	696,625	825,191	186,958	545,954	122,504	1,195,714
	Long	0	590,014	10,945,512	4,985,323	0	1,176,855	630,623	332,126	0	43,238	0	679,108
	International	0	0	45,206,220	5,488,260	0	0	0	0	0	0	0	0
	Total Cargo (tons)	0.0	73,398.8	3,456,049.0	2,771,425.3	0.0	33,600.4	66,002.4	15,069.2	117,827.5	866,619.4	291,562.9	1,209,345.0
	Domestic (tons)	0.0	73,398.8	2,036,243.3	1,857,165.6	0.0	33,600.4	66,002.4	15,069.2	103,495.1	713,067.6	257,356.0	1,029,209.4
	International (tons)	0.0	0.0	1,419,805.7	914,259.7	0.0	0.0	0.0	0.0	14,332.4	153,551.7	34,206.9	180,135.7

Footnotes
[1] *Constrained*
[2] *Legally constrained*
[3] *Includes Oxnard Airport*
[4] *Limited to 50 daily operations by Joint Use Agreement (can be expanded to 400 with EIS)*
[5] *Current Terminal*
[6] *New Terminal*
[7] *Physically constrained*

Table E-2

HISTORICAL (1960 – 1998) AND PROJECTED (2020) AIR PASSENGER VOLUMES (000s)

Year	MUG	Burbank	John Wayne	El Toro	Long Beach	Los Angeles	Ontario	Palm Springs	PMD	SBD	SCI	MAR	TOTAL
1960		864	12		-	6,065	-	-	-				6,941
1961		862	17		-	6,947	29	-	-				7,855
1962		810	20		-	7,633	44	40	-				8,547
1963		628	25		-	9,904	99	62	-				10,718
1964		570	333		-	10,696	146	79	-				11,824
1965		707	46		-	12,579	188	92	-				13,612
1966		876	65		-	15,251	248	105	-				16,545
1967		1,899	394		-	18,125	399	122	-				20,939
1968		721	722		314	20,346	573	215	-				22,891
1969		1,178	848		288	21,310	744	239	-				24,607
1970		1,319	948		89	20,781	873	268	-				24,278
1971		1,362	1,127		223	20,347	955	268	-				24,282
1972		1,475	1,409		262	22,078	1,029	288	-				26,541
1973		1,571	1,563		257	23,502	1,172	320	-				28,385
1974		1,643	1,583		245	23,585	1,250	335	-				28,641
1975		1,631	1,825		320	23,719	1,289	346	-				29,130
1976		1,716	2,159		332	25,983	1,435	428	-				32,053
1977		1,999	2,381		404	28,362	1,681	506	-				35,333
1978		2,251	2,556		400	32,901	2,005	561	-				40,674
1979		2,386	2,379		392	34,923	2,361	623	-				43,064
1980		1,917	2,379		162	33,040	2,005	519	-				40,022
1981		1,901	2,380		180	32,723	1,805	443	-				39,432
1982		2,432	2,531		430	32,383	2,024	398	-				40,198
1983		2,847	2,794		826	33,427	2,472	514	-				42,880
1984		2,745	2,827		1,079	34,362	3,073	604	-				44,690
1985		2,917	3,284		1,104	36,258	3,609	605	-				47,777
1986		3,021	4,059		1,118	41,418	4,245	714	-				54,575
1987		3,167	4,564		1,207	44,873	4,575	834	-				59,220
1988		3,043	4,674		1,170	44,399	4,798	829	-				58,913
1989		2,718	4,516		1,379	45,048	5,299	860	-				59,820
1990		3,493	4,587		1,456	45,810	5,420	915	-				61,681
1991		3,712	4,855		1,353	45,668	5,792	858	-				62,238
1992		3,828	5,673		834	46,965	6,121	882	88				64,391
1993		4,349	6,142		612	47,845	6,192	825	122				66,087
1994		4,838	6,774		490	51,050	6,386	979	129				70,646
1995		4,973	7,159		425	53,909	6,405	947	113				73,931
1996		4,838	7,308		435	57,975	6,242	1,115	113				78,026
1997		4,718	7,718		611	59,177	6,296	1,180	104				79,804
1998		4,732	7,460		647	61,216	6,435	1,256	104				81,850
Forecast Scenarios													
MED RTP	1,963	9,236	7,003	22,207	2,803	94,181	15,368	1,699	130	1,780	125	914	157,410
2C-HSR	3,029	9,410	9,399	28,800	3,000	70,000	26,098	1,794	1,157	1,307	466	1,629	156,089
SCE 8	-	9,410	8,400	25,102	3,000	78,008	25,577	2,235	1,398	1,456	608	1,274	156,469
SCE 9	-	9,410	8,400	-	3,000	86,401	33,798	3,014	1,224	2,883	1,200	5,490	154,819
SCE 6	-	9,410	8,400	-	3,000	78,010	20,020	3,630	3,990	6,010	1,600	6,780	140,850

Source: Southern California Association of Governments

Table E-3

HISTORICAL (1965 – 1998) AND PROJECTED (2020) AIR CARGO VOLUMES

(Tons)

Year	MOGU	Burbank	John Wayne	Long Beach	Los Angeles	Ontario	Palm Springs	Palmdale	El Toro	SBD	SCI	MAR	Total
1965		-	-	-	261,766	-	-	-					261,766
1966		-	-	-	305,363	-	-	-					305,363
1967		-	-	-	360,264	-	-	-					360,264
1968		-	-	-	419,639	-	-	-					419,639
1969		-	-	-	478,321	-	-	-					478,321
1970		-	-	-	521,470	-	-	-					521,470
1971		-	-	-	567,404	-	-	-					567,404
1972		-	-	-	655,771	-	-	-					655,771
1973		-	-	-	721,035	-	-	-					721,035
1974		-	-	-	741,612	-	-	-					741,612
1975		-	-	-	714,961	2,917	-	-					717,878
1976		-	-	-	770,899	-	-	-					770,899
1977		-	-	-	812,290	-	-	-					812,290
1978		-	-	-	917,798	-	-	-					917,798
1979		10,204	-	1,056	900,600	8,543	-	-					920,403
1980		-	-	664	881,889	4,773	-	-					887,326
1981		7,776	-	872	903,586	9,580	-	-					921,814
1982		6,575	-	1,400	857,725	56,003	-	-					921,703
1983		7,422	-	2,431	904,793	94,600	-	-					1,009,246
1984		6,557	-	4,290	948,599	147,529	-	-					1,106,975
1985		6,655	-	3,817	929,243	176,488	-	-					1,116,203
1986		12,357	-	3,069	1,016,803	199,978	-	-					1,232,207
1987		13,249	-	5,806	1,160,026	218,914	-	-					1,397,995
1988		12,429	-	3,436	1,212,262	286,411	383	-					1,514,921
1989		14,853	-	4,876	1,245,939	284,988	398	-					1,551,054
1990		20,161	-	18,882	1,284,373	246,300	422	8					1,570,146
1991		17,435	-	26,456	1,258,209	282,558	362	5					1,585,025
1992		18,030	-	27,113	1,365,157	306,973	329	4					1,717,606
1993		28,444	-	30,656	1,462,330	353,302	313	5					1,875,050
1994		31,002	-	27,732	1,703,445	379,911	297	3					2,142,390
1995		36,043	15,778	26,567	1,760,995	386,953	224	2					2,226,562
1996		39,623	20,012	29,957	1,895,751	437,139	240	2					2,422,724
1997		36,325	21,727	34,481	2,052,993	461,747	233	1					2,607,507
1998		40,032	17,829	41,469	2,051,800	454,231	198	0					2,605,559
Forecast Scenarios													
Med RTP	9,104	70,000	25,898	59,987	3,943,447	1,241,283	16,596	16,670	1,331,829	885,213	300,237	1,000,012	8,900,277
SCE 2C	212,045	67,752	24,438	63,003	2,590,001	2,087,868	14,171	114,902	1,699,206	770,947	263,132	993,411	8,900,877
SCE 8	-	73,399	25,200	63,002	2,974,426	2,046,148	17,882	119,989	1,506,141	801,048	291,279	982,385	8,900,899
SCE 9	-	73,399	33,600	66,002	3,456,049	2,771,425	15,069	117,828	-	866,619	291,563	1,209,345	8,900,900

Source: Southern California Association of Governments

COMPARISON OF SCAG REGION ECONOMY
(1996 IMPLAN Baseline v. 2020 Forecast Model)

	IMPLAN SCAG Model		2020 Employment Forecast		Price Change To 1998 Base and Real Output Forecast					
Sector	1996 Industry Output*	1996 Employment	SCAG Employment Forecast	Estimated 2020 Employment	Change In Price Index 1996-1998	1996 Industry Output* (1998 $Mil.)	Real Productivity Annual Rate Of Change	Combined Real Output Change 1996 - 2020	2020 Industry Output* (1998 $Mil.)	Percent Change
Livestock & Livestock Products	$1,586.92 M	11,744	-18.9%	9,524	4.9%	$1,665 M	1.6%	119.9%	$1,996 M	19.9%
Agriculture	$2,410.86 M	32,706	-18.9%	26,525	4.9%	$2,530 M	1.1%	106.0%	$2,682 M	6.0%
Forestry & Forest Products	$59.44 M	434	-18.9%	352	2.8%	$61 M	1.2%	107.2%	$65 M	6.6%
Commercial Fishing	$37.08 M	782	-18.9%	634	1.6%	$38 M	1.7%	121.6%	$46 M	21.1%
Agricultural Services	$2,220.16 M	91,396	132.1%	212,131	2.8%	$2,283 M	0.0%	232.1%	$5,299 M	132.1%
Mining	$3,774.92 M	18,271	-80.5%	3,563	-0.8%	$3,746 M	0.1%	19.9%	$745 M	-80.1%
Construction	$38,198.10 M	416,776	0.0%	416,776	3.9%	$39,707 M	0.7%	118.3%	$46,973 M	18.3%
Food Processing	$17,619.17 M	66,316	-19.1%	53,650	1.9%	$17,955 M	2.3%	140.0%	$25,137 M	40.0%
Tobacco	$15.10 M	32	-19.1%	26	2.9%	$16 M	3.1%	168.2%	$27 M	68.8%
Textiles	$2,840.47 M	24,925	1.9%	25,399	2.3%	$2,905 M	1.8%	155.7%	$4,523 M	55.7%
Apparel	$10,160.87 M	125,342	-24.9%	94,132	0.7%	$10,232 M	2.9%	150.8%	$15,430 M	50.8%
Wood Products	$1,961.80 M	21,452	14.2%	24,498	2.4%	$2,008 M	0.8%	139.9%	$2,809 M	39.9%
Furniture	$4,244.24 M	41,656	5.7%	44,031	2.6%	$4,355 M	2.0%	169.9%	$7,399 M	69.9%
Pulp and Paper	$5,165.50 M	24,736	23.8%	30,624	16.9%	$6,038 M	1.5%	175.8%	$10,615 M	75.8%
Printing & Publishing	$10,998.48 M	95,559	33.0%	127,093	5.8%	$11,637 M	0.7%	155.4%	$18,084 M	55.4%
Chemicals	$8,983.41 M	35,571	11.0%	39,484	5.2%	$9,453 M	2.7%	210.8%	$19,927 M	110.8%
Petroleum & Coal Products	$16,610.56 M	10,821	-46.0%	5,843	3.3%	$17,165 M	3.1%	111.9%	$19,208 M	11.9%
Rubber Products	$7,759.12 M	51,070	45.2%	74,153	5.0%	$8,146 M	3.1%	300.5%	$24,479 M	200.5%
Leather Products	$419.94 M	6,317	-67.6%	2,047	4.2%	$437 M	1.6%	47.3%	$207 M	-52.6%
Stone Clay & Glass Products	$3,320.32 M	24,103	-27.1%	17,571	4.1%	$3,457 M	2.8%	142.3%	$4,919 M	42.3%
Primary Metals	$4,988.29 M	22,630	-24.1%	17,176	9.6%	$5,468 M	2.7%	143.1%	$7,825 M	43.1%
Fabricated Metals	$11,837.96 M	83,296	-17.2%	68,969	3.6%	$12,260 M	2.6%	155.1%	$19,015 M	55.1%
Industrial Machinery	$5,204.06 M	35,086	-26.6%	25,753	2.7%	$5,346 M	2.8%	141.3%	$7,554 M	41.3%
Electrical Machinery	$24,646.83 M	140,083	-9.8%	126,355	-2.2%	$24,096 M	2.9%	179.5%	$43,252 M	79.5%
Transportation Equipment	$21,148.45 M	111,277	3.5%	115,172	1.5%	$21,473 M	2.7%	197.3%	$42,366 M	97.3%
Scientific Instruments	$16,636.37 M	91,444	9.2%	99,857	1.7%	$16,918 M	3.1%	226.6%	$38,336 M	126.6%
Miscellaneous Manufacturing	$3,419.98 M	36,511	-30.9%	25,229	2.0%	$3,490 M	2.4%	122.9%	$4,289 M	22.9%
Railroads and Related Services	$1,242.09 M	6,673	-8.7%	6,093	-0.1%	$1,241 M	1.7%	136.8%	$1,698 M	36.8%
Local, Interurban Passenger Transit	$951.05 M	23,162	19.4%	27,655	1.5%	$966 M	1.3%	162.8%	$1,573 M	62.8%
Motor Freight Transport and Warehousing	$9,664.34 M	93,612	32.4%	123,942	2.7%	$9,926 M	2.9%	262.9%	$26,095 M	162.9%
Water Transportation	$2,812.65 M	10,676	16.3%	12,416	6.2%	$2,987 M	1.7%	174.3%	$5,206 M	74.3%
Air Transportation	$7,221.73 M	66,170	66.8%	110,372	2.3%	$7,384 M	1.8%	252.9%	$18,674 M	152.9%
Other Transportation	$7,838.32 M	105,064	107.7%	218,217	6.7%	$8,366 M	1.2%	278.9%	$23,333 M	178.9%
Communications & Public Utilities	$34,702.61 M	110,443	24.0%	136,950	0.6%	$34,910 M	1.4%	174.6%	$60,953 M	74.6%
Wholesale Trade	$50,543.64 M	458,154	35.7%	621,715	2.8%	$51,976 M	1.7%	203.4%	$105,719 M	103.4%
Other Retail Trade	$38,532.10 M	867,972	48.6%	1,289,807	1.5%	$39,091 M	1.3%	200.7%	$78,456 M	100.7%
Eating & Drinking	$15,846.08 M	423,934	48.6%	629,965	2.3%	$16,211 M	0.0%	148.6%	$24,090 M	48.6%
FIRE	$148,519.67 M	598,949	39.1%	833,138	3.1%	$153,092 M	1.7%	209.3%	$320,422 M	109.3%
Hotels and Lodging Places	$5,015.52 M	84,512	61.7%	136,655	4.2%	$5,227 M	0.8%	195.8%	$10,234 M	95.8%
Personal Services	$6,059.77 M	177,784	75.5%	312,010	2.8%	$6,230 M	1.6%	257.1%	$16,017 M	157.1%
Business Services	$31,606.48 M	609,892	194.5%	1,796,131	5.8%	$33,434 M	1.3%	397.7%	$132,967 M	297.7%
Automobile Rental and Leasing	$2,077.01 M	16,626	61.7%	26,884	3.6%	$2,152 M	0.0%	161.7%	$3,480 M	61.7%
Auto Repair Services	$7,305.87 M	104,567	94.8%	203,697	2.5%	$7,486 M	1.2%	257.8%	$19,299 M	157.8%
All Other Services	$128,554.40 M	1,700,913	135.3%	4,002,247	3.6%	$133,189 M	0.7%	279.4%	$372,130 M	179.4%
Amusement and Recreation Services, N.E.C.	$4,492.30 M	124,786	136.5%	295,119	3.2%	$4,636 M	2.7%	448.3%	$20,783 M	348.3%
Other State and Local Govt Enterprises	$5,886.53 M	24,696	43.1%	35,340	2.8%	$6,052 M	0.0%	143.1%	$8,660 M	43.1%
Other Federal Government Enterprises	$532.55 M	3,082	-26.6%	2,262	1.1%	$538 M	1.7%	110.0%	$592 M	10.0%
Noncomparable Imports	$0.00 M	0	0.0%	0		$0 M	0.0%	100.0%	$0 M	
Scrap	$0.00 M	0	0.0%	0		$0 M	0.0%	100.0%	$0 M	
Used and Secondhand Goods	$0.00 M	0	0.0%	0		$0 M	0.0%	100.0%	$0 M	
Federal Government - Military	$3,644.39 M	67,490	-30.7%	46,770	1.1%	$3,684 M	1.7%	103.9%	$3,828 M	3.9%
Federal Government - Non-Military	$4,267.13 M	84,933	-25.3%	63,445	1.1%	$4,313 M	0.0%	74.7%	$3,222 M	-25.3%
Commoodity Credit Corporation	$0.00 M	0	0.0%	0		$0 M	0.0%	100.0%	$0 M	
State & Local Government - Education	$14,661.06 M	408,380	48.2%	605,220	2.8%	$15,074 M	1.7%	222.1%	$33,479 M	122.1%
State & Local Government - Non-Education	$18,510.48 M	319,328	24.5%	397,564	2.8%	$19,032 M	0.0%	124.5%	$23,695 M	24.5%
ROW IVA	-$122.94 M	0	0.0%	0		-$123 M	1.5%	143.0%	-$176 M	43.1%
Domestic Services	$1,426.52 M	127,670	0.0%	127,670	3.3%	$1,473 M	2.9%	198.6%	$2,925 M	98.6%
Totals	$778,059.77 M	8,239,805	66.8%	13,747,851	3.0%	$801,432 M			$1,690,561 M	110.9%

APPENDIX F

SCAG REGION
55-SECTOR MODEL SUMMARY OF ECONOMIC IMPACTS
BY 2020 RTP FORECAST SCENARIO
FOR:
OUTPUT, INCOME, EMPLOYMENT, AND TAXES

Table F-1

Level-1,2,and 3 Combined Total Economic Impacts

2020 SCAG REGION OUTPUT ATTRIBUTABLE TO AIRPORT RELATED ECONOMIC ACTIVITY (In Millions of 1998 $s)

Sector	RTP Medium	H2C	SCE #8	SCE #9	SCE #6	2020 Economy Total	RTP % of Total Economy
Livestock & Livestock Products	$67 M	$66 M	$66 M	$67 M	$59 M	$1,996 M	3.4%
Agriculture	$47 M	$46 M	$47 M	$47 M	$42 M	$2,682 M	1.8%
Forestry & Forest Products	$1 M	$1 M	$1 M	$1 M	$1 M	$65 M	1.7%
Commercial Fishing	$16 M	$16 M	$16 M	$16 M	$15 M	$46 M	35.8%
Agricultural Services	$52 M	$51 M	$52 M	$52 M	$46 M	$5,299 M	1.0%
Mining	$57 M	$56 M	$57 M	$56 M	$51 M	$745 M	7.6%
Construction	$861 M	$848 M	$855 M	$858 M	$762 M	$46,973 M	1.8%
Food Processing	$801 M	$785 M	$794 M	$800 M	$705 M	$25,137 M	3.2%
Tobacco	$1 M	$1 M	$1 M	$1 M	$1 M	$27 M	2.4%
Textiles	$312 M	$309 M	$310 M	$308 M	$279 M	$4,523 M	6.9%
Apparel	$1,283 M	$1,271 M	$1,275 M	$1,263 M	$1,147 M	$15,430 M	8.3%
Wood Products	$26 M	$26 M	$26 M	$26 M	$23 M	$2,809 M	0.9%
Furniture	$248 M	$246 M	$246 M	$244 M	$221 M	$7,399 M	3.4%
Pulp and Paper	$435 M	$429 M	$432 M	$431 M	$387 M	$10,615 M	4.1%
Printing & Publishing	$655 M	$646 M	$650 M	$649 M	$581 M	$18,084 M	3.6%
Chemicals	$897 M	$887 M	$891 M	$885 M	$800 M	$19,927 M	4.5%
Petroleum & Coal Products	$1,890 M	$1,870 M	$1,878 M	$1,866 M	$1,686 M	$19,208 M	9.8%
Rubber Products	$194 M	$192 M	$193 M	$191 M	$174 M	$24,479 M	0.8%
Leather Products	$30 M	$30 M	$30 M	$30 M	$27 M	$207 M	14.6%
Stone Clay & Glass Products	$90 M	$89 M	$89 M	$89 M	$80 M	$4,919 M	1.8%
Primary Metals	$355 M	$352 M	$353 M	$349 M	$318 M	$7,825 M	4.5%
Fabricated Metals	$514 M	$510 M	$511 M	$506 M	$460 M	$19,015 M	2.7%
Industrial Machinery	$1,434 M	$1,422 M	$1,425 M	$1,411 M	$1,283 M	$7,554 M	19.0%
Electrical Machinery	$9,790 M	$9,705 M	$9,731 M	$9,633 M	$8,756 M	$43,252 M	22.6%
Transportation Equipment	$4,593 M	$4,554 M	$4,565 M	$4,517 M	$4,109 M	$42,366 M	10.8%
Scientific Instruments	$5,126 M	$5,082 M	$5,095 M	$5,043 M	$4,586 M	$38,336 M	13.4%
Miscellaneous Manufacturing	$712 M	$705 M	$708 M	$702 M	$636 M	$4,289 M	16.6%
Railroads and Related Services	$92 M	$91 M	$91 M	$91 M	$82 M	$1,698 M	5.4%
Local, Interurban Passenger Transit	$438 M	$426 M	$433 M	$442 M	$382 M	$1,239 M	35.4%
Motor Freight Transport and Warehousing	$604 M	$595 M	$600 M	$599 M	$536 M	$26,095 M	2.3%
Water Transportation	$90 M	$89 M	$89 M	$89 M	$80 M	$5,206 M	1.7%
Air Transportation	$18,593 M	$18,436 M	$18,482 M	$18,289 M	$16,636 M	$18,586 M	100.0%
Other Transportation	$1,887 M	$1,860 M	$1,873 M	$1,873 M	$1,674 M	$23,333 M	8.1%
Communications & Public Utilities	$2,246 M	$2,211 M	$2,230 M	$2,234 M	$1,989 M	$60,953 M	3.7%
Wholesale Trade	$3,294 M	$3,253 M	$3,271 M	$3,259 M	$2,930 M	$105,719 M	3.1%
Other Retail Trade	$10,965 M	$10,681 M	$10,807 M	$10,957 M	$9,583 M	$78,456 M	14.0%
Eating & Drinking	$5,068 M	$4,937 M	$5,014 M	$5,107 M	$4,423 M	$24,090 M	21.0%
FIRE	$5,442 M	$5,356 M	$5,402 M	$5,415 M	$4,817 M	$320,422 M	1.7%
Hotels and Lodging Places	$6,565 M	$6,408 M	$6,521 M	$6,650 M	$5,736 M	$10,234 M	64.1%
Personal Services	$285 M	$281 M	$283 M	$284 M	$252 M	$16,017 M	1.8%
Business Services	$2,921 M	$2,877 M	$2,899 M	$2,902 M	$2,589 M	$132,967 M	2.2%
Automobile Rental and Leasing	$1,230 M	$1,211 M	$1,234 M	$1,254 M	$1,084 M	$3,480 M	35.4%
Auto Repair Services	$432 M	$426 M	$429 M	$429 M	$384 M	$19,299 M	2.2%
All Other Services	$5,948 M	$5,846 M	$5,899 M	$5,923 M	$5,256 M	$372,130 M	1.6%
Amusement and Recreation Services, N.E.C.	$1,230 M	$1,194 M	$1,213 M	$1,239 M	$1,069 M	$20,783 M	5.9%
Other State and Local Govt Enterprises	$326 M	$322 M	$324 M	$324 M	$289 M	$8,660 M	3.8%
Other Federal Government Enterprises	$21 M	$21 M	$21 M	$21 M	$19 M	$592 M	3.6%
Household Income *	$26,968 M	$34,841 M	$35,073 M	$35,059 M	$31,559 M	$676,244 M	4.0%
Total Outlay	$98,165 M	$96,718 M	$97,414 M	$97,421 M	$87,044 M	$1,623,166 M	6.0%
Percentage of Total SCAG Regional Economy	6.0%	6.0%	6.0%	6.0%	5.4%	100.0%	

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

Table F-2

Level-1,2,and 3 Combined Total Economic Impacts

2020 SCAG REGION INCOME ATTRIBUTABLE TO AIRPORT RELATED ECONOMIC ACTIVITY (In Millions of 1998 $s)

Sector	RTP Medium	H2C	SCE #8	SCE #9	SCE #6	2020 Economy Total	RTP % of Total Economy
Livestock & Livestock Products	$10 M	$17 M	$17 M	$17 M	$15 M	$509 M	2.0%
Agriculture	$12 M	$16 M	$16 M	$16 M	$14 M	$920 M	1.3%
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	$5 M	1.6%
Commercial Fishing	$8 M	$8 M	$8 M	$8 M	$8 M	$24 M	35.6%
Agricultural Services	$16 M	$32 M	$32 M	$33 M	$29 M	$3,317 M	0.5%
Mining	$12 M	$13 M	$13 M	$13 M	$12 M	$175 M	6.8%
Construction	$208 M	$348 M	$352 M	$353 M	$313 M	$19,312 M	1.1%
Food Processing	$67 M	$123 M	$125 M	$126 M	$111 M	$3,953 M	1.7%
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	$4 M	1.9%
Textiles	$71 M	$74 M	$74 M	$74 M	$67 M	$1,085 M	6.5%
Apparel	$322 M	$328 M	$329 M	$326 M	$296 M	$3,980 M	8.1%
Wood Products	$7 M	$9 M	$9 M	$9 M	$8 M	$947 M	0.7%
Furniture	$68 M	$72 M	$72 M	$71 M	$65 M	$2,156 M	3.1%
Pulp and Paper	$75 M	$100 M	$100 M	$100 M	$90 M	$2,463 M	3.1%
Printing & Publishing	$184 M	$246 M	$248 M	$247 M	$222 M	$6,894 M	2.7%
Chemicals	$159 M	$177 M	$178 M	$177 M	$160 M	$3,985 M	4.0%
Petroleum & Coal Products	$126 M	$133 M	$133 M	$133 M	$120 M	$1,364 M	9.2%
Rubber Products	$45 M	$45 M	$45 M	$44 M	$40 M	$5,696 M	0.8%
Leather Products	$8 M	$10 M	$10 M	$10 M	$9 M	$67 M	12.2%
Stone Clay & Glass Products	$25 M	$26 M	$26 M	$26 M	$24 M	$1,449 M	1.7%
Primary Metals	$72 M	$72 M	$72 M	$71 M	$65 M	$1,594 M	4.5%
Fabricated Metals	$150 M	$152 M	$152 M	$151 M	$137 M	$5,669 M	2.6%
Industrial Machinery	$441 M	$441 M	$443 M	$438 M	$398 M	$2,346 M	18.8%
Electrical Machinery	$2,705 M	$2,723 M	$2,731 M	$2,703 M	$2,457 M	$12,137 M	22.3%
Transportation Equipment	$1,572 M	$1,561 M	$1,565 M	$1,549 M	$1,409 M	$14,524 M	10.8%
Scientific Instruments	$1,791 M	$1,790 M	$1,795 M	$1,776 M	$1,615 M	$13,505 M	13.3%
Miscellaneous Manufacturing	$201 M	$212 M	$213 M	$211 M	$191 M	$1,288 M	15.6%
Railroads and Related Services	$28 M	$35 M	$36 M	$35 M	$32 M	$662 M	4.2%
Local, Interurban Passenger Transit	$27 M	$254 M	$258 M	$263 M	$227 M	$737 M	3.7%
Motor Freight Transport and Warehousing	$141 M	$193 M	$194 M	$194 M	$174 M	$8,465 M	1.7%
Water Transportation	$20 M	$25 M	$25 M	$25 M	$22 M	$1,451 M	1.4%
Air Transportation	$7,756 M	$7,712 M	$7,731 M	$7,650 M	$6,959 M	$7,775 M	99.8%
Other Transportation	$847 M	$1,213 M	$1,221 M	$1,221 M	$1,091 M	$15,213 M	5.6%
Communications & Public Utilities	$378 M	$509 M	$513 M	$514 M	$458 M	$14,020 M	2.7%
Wholesale Trade	$1,163 M	$1,320 M	$1,327 M	$1,322 M	$1,189 M	$42,893 M	2.7%
Other Retail Trade	$1,801 M	$1,828 M	$1,850 M	$1,875 M	$1,640 M	$40,286 M	4.5%
Eating & Drinking	$566 M	$1,895 M	$1,924 M	$1,960 M	$1,697 M	$9,246 M	6.1%
FIRE	$708 M	$797 M	$804 M	$806 M	$717 M	$47,667 M	1.5%
Hotels and Lodging Places	$519 M	$2,450 M	$2,493 M	$2,543 M	$2,193 M	$3,913 M	13.3%
Personal Services	$80 M	$132 M	$133 M	$134 M	$119 M	$7,527 M	1.1%
Business Services	$1,098 M	$1,631 M	$1,643 M	$1,645 M	$1,467 M	$75,374 M	1.5%
Automobile Rental and Leasing	$101 M	$343 M	$350 M	$356 M	$307 M	$987 M	10.2%
Auto Repair Services	$114 M	$154 M	$155 M	$155 M	$139 M	$6,990 M	1.6%
All Other Services	$1,793 M	$3,112 M	$3,140 M	$3,153 M	$2,798 M	$198,086 M	0.9%
Amusement and Recreation Services, N.E.C.	$86 M	$429 M	$436 M	$445 M	$384 M	$7,473 M	1.1%
Other State and Local Govt Enterprises	$47 M	$72 M	$72 M	$72 M	$65 M	$1,932 M	2.4%
Other Federal Government Enterprises	$4 M	$6 M	$6 M	$6 M	$6 M	$172 M	2.4%
Household Income	$1,335 M	$2,002 M	$2,002 M	$2,002 M	$2,002 M	$76,006 M	1.8%
Total Outlay	$26,968 M	$34,841 M	$35,073 M	$35,059 M	$31,559 M	$676,244 M	4.0%
Percentage of Total SCAG Regional Economy	4.0%	5.2%	5.2%	5.2%	4.7%	100.0%	

Table F-3

Level-1,2,and 3 Combined Total Economic Impacts

2020 SCAG REGION EMPLOYMENT
ATTRIBUTABLE TO AIRPORT RELATED ECONOMIC ACTIVITY
(In Millions of 1998 $s)

Sector	RTP Total	H2C Total	SCE 8 Total	SCE 9 Total	SCE 6 Total	2020 Economy Total	RTP Percent of Total
Livestock & Livestock Products	319	314	317	318	282	9,524	3.4%
Agriculture	466	459	462	462	414	26,525	1.8%
Forestry & Forest Products	6	6	6	6	5	352	1.7%
Commercial Fishing	227	225	226	223	203	634	35.8%
Agricultural Services	2,093	2,056	2,078	2,092	1,847	212,131	1.0%
Mining	273	269	271	269	243	3,563	7.6%
Construction	7,643	7,520	7,587	7,611	6,762	416,776	1.8%
Food Processing	1,709	1,676	1,694	1,707	1,505	53,650	3.2%
Tobacco	1	1	1	1	1	26	2.4%
Textiles	1,753	1,737	1,743	1,727	1,567	25,399	6.9%
Apparel	7,825	7,756	7,778	7,703	6,997	94,132	8.3%
Wood Products	230	227	229	228	205	24,498	0.9%
Furniture	1,475	1,461	1,466	1,454	1,318	44,031	3.4%
Pulp and Paper	1,256	1,239	1,247	1,245	1,116	30,624	4.1%
Printing & Publishing	4,600	4,538	4,568	4,560	4,086	127,093	3.6%
Chemicals	1,777	1,758	1,765	1,754	1,585	39,484	4.5%
Petroleum & Coal Products	575	569	571	568	513	5,843	9.8%
Rubber Products	588	583	584	578	526	74,153	0.8%
Leather Products	300	296	298	296	267	2,047	14.6%
Stone Clay & Glass Products	321	318	319	317	287	17,571	1.8%
Primary Metals	780	773	775	767	698	17,176	4.5%
Fabricated Metals	1,865	1,848	1,853	1,835	1,667	68,969	2.7%
Industrial Machinery	4,888	4,846	4,859	4,809	4,373	25,753	19.0%
Electrical Machinery	28,600	28,351	28,427	28,142	25,580	126,355	22.6%
Transportation Equipment	12,485	12,380	12,410	12,280	11,171	115,172	10.8%
Scientific Instruments	13,352	13,238	13,272	13,135	11,944	99,857	13.4%
Miscellaneous Manufacturing	4,189	4,149	4,163	4,127	3,742	25,229	16.6%
Railroads and Related Services	330	326	327	327	293	6,093	5.4%
Local, Interurban Passenger Transit	7,881	7,675	7,797	7,947	6,874	27,655	28.5%
Motor Freight Transport and Warehousing	2,868	2,828	2,848	2,845	2,546	123,942	2.3%
Water Transportation	215	212	213	212	191	12,416	1.7%
Air Transportation	109,883	108,955	109,225	108,084	98,315	109,842	100.0%
Other Transportation	17,650	17,395	17,521	17,518	15,656	218,217	8.1%
Communications & Public Utilities	5,047	4,969	5,010	5,020	4,469	136,950	3.7%
Wholesale Trade	19,369	19,131	19,238	19,166	17,233	621,715	3.1%
Other Retail Trade	60,090	58,533	59,225	60,043	52,517	1,289,807	4.7%
Eating & Drinking	132,528	129,113	131,117	133,541	115,658	629,965	21.0%
FIRE	14,150	13,927	14,046	14,080	12,526	833,138	1.7%
Hotels and Lodging Places	87,658	85,568	87,076	88,804	76,595	136,655	64.1%
Personal Services	5,558	5,468	5,517	5,536	4,916	312,010	1.8%
Business Services	39,452	38,862	39,162	39,197	34,967	1,796,131	2.2%
Automobile Rental and Leasing	9,506	9,351	9,530	9,687	8,372	26,884	35.4%
Auto Repair Services	4,561	4,498	4,530	4,527	4,048	203,697	2.2%
All Other Services	63,967	62,870	63,439	63,703	56,523	4,002,247	1.6%
Amusement and Recreation Services, N.E.C.	17,467	16,957	17,226	17,593	15,183	295,119	5.9%
Other State and Local Govt Enterprises	1,332	1,312	1,322	1,323	1,181	35,340	3.8%
Other Federal Government Enterprises	82	81	81	81	73	2,262	3.6%
Household Income	7,099	6,998	7,047	7,044	6,299	127,670	5.6%
Total Outlay	706,287	693,620	700,464	704,492	623,336	12,634,322	5.6%
Percentage of Total SCAG Regional Economy	5.6%	5.5%	5.5%	5.6%	4.9%	100.0%	

Table F-4

Level-1,2,and 3 Combined Total Economic Impacts

2020 SCAG REGION TAXES ATTRIBUTABLE TO AIRPORT RELATED ECONOMIC ACTIVITY
(In Millions of 1998 $s)

Sector	RTP Total	H2C Total	SCE 8 Total	SCE 9 Total	SCE 6 Total	2020 Economy Total	RTP Percent of Total
Livestock & Livestock Products	$1 M	$1 M	$1 M	$1 M	$0 M	$16 M	3.4%
Agriculture	$1 M	$1 M	$1 M	$1 M	$1 M	$57 M	1.8%
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	$5 M	1.7%
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	$1 M	35.8%
Agricultural Services	$2 M	$1 M	$2 M	$2 M	$1 M	$153 M	1.0%
Mining	$4 M	$3 M	$3 M	$3 M	$3 M	$46 M	7.6%
Construction	$7 M	$7 M	$7 M	$7 M	$6 M	$369 M	1.8%
Food Processing	$19 M	$18 M	$19 M	$19 M	$16 M	$586 M	3.2%
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	$1 M	2.4%
Textiles	$2 M	$2 M	$2 M	$2 M	$2 M	$30 M	6.9%
Apparel	$5 M	$5 M	$5 M	$5 M	$4 M	$59 M	8.3%
Wood Products	$0 M	$0 M	$0 M	$0 M	$0 M	$15 M	0.9%
Furniture	$1 M	$1 M	$1 M	$1 M	$1 M	$42 M	3.4%
Pulp and Paper	$5 M	$5 M	$5 M	$5 M	$4 M	$122 M	4.1%
Printing & Publishing	$7 M	$7 M	$7 M	$7 M	$6 M	$200 M	3.6%
Chemicals	$9 M	$9 M	$9 M	$9 M	$8 M	$193 M	4.5%
Petroleum & Coal Products	$67 M	$67 M	$67 M	$66 M	$60 M	$683 M	9.8%
Rubber Products	$1 M	$1 M	$1 M	$1 M	$1 M	$154 M	0.8%
Leather Products	$0 M	$0 M	$0 M	$0 M	$0 M	$1 M	14.6%
Stone Clay & Glass Products	$1 M	$1 M	$1 M	$1 M	$1 M	$69 M	1.8%
Primary Metals	$4 M	$4 M	$4 M	$4 M	$4 M	$92 M	4.5%
Fabricated Metals	$5 M	$5 M	$5 M	$5 M	$5 M	$190 M	2.7%
Industrial Machinery	$11 M	$11 M	$11 M	$11 M	$10 M	$59 M	19.0%
Electrical Machinery	$82 M	$82 M	$82 M	$81 M	$74 M	$363 M	22.6%
Transportation Equipment	$43 M	$43 M	$43 M	$42 M	$38 M	$396 M	10.8%
Scientific Instruments	$35 M	$35 M	$35 M	$35 M	$32 M	$264 M	13.4%
Miscellaneous Manufacturing	$13 M	$13 M	$13 M	$13 M	$12 M	$78 M	16.6%
Railroads and Related Services	$2 M	$2 M	$2 M	$2 M	$2 M	$44 M	5.4%
Local, Interurban Passenger Transit	$5 M	$5 M	$5 M	$5 M	$5 M	$15 M	35.4%
Motor Freight Transport and Warehousing	$9 M	$9 M	$9 M	$9 M	$8 M	$410 M	2.3%
Water Transportation	$3 M	$3 M	$3 M	$3 M	$3 M	$183 M	1.7%
Air Transportation	$581 M	$576 M	$578 M	$572 M	$520 M	$581 M	100.0%
Other Transportation	$20 M	$19 M	$20 M	$20 M	$18 M	$244 M	8.1%
Communications & Public Utilities	$157 M	$155 M	$156 M	$157 M	$139 M	$4,270 M	3.7%
Wholesale Trade	$507 M	$501 M	$504 M	$502 M	$451 M	$16,279 M	3.1%
Other Retail Trade	$1,766 M	$1,720 M	$1,740 M	$1,764 M	$1,543 M	$12,633 M	14.0%
Eating & Drinking	$362 M	$352 M	$358 M	$364 M	$316 M	$1,719 M	21.0%
FIRE	$554 M	$545 M	$550 M	$551 M	$491 M	$32,627 M	1.7%
Hotels and Lodging Places	$426 M	$416 M	$424 M	$432 M	$373 M	$665 M	64.1%
Personal Services	$8 M	$8 M	$8 M	$8 M	$7 M	$453 M	1.8%
Business Services	$54 M	$53 M	$54 M	$54 M	$48 M	$2,471 M	2.2%
Automobile Rental and Leasing	$86 M	$85 M	$86 M	$88 M	$76 M	$243 M	35.4%
Auto Repair Services	$18 M	$18 M	$18 M	$18 M	$16 M	$817 M	2.2%
All Other Services	$66 M	$65 M	$65 M	$66 M	$58 M	$4,122 M	1.6%
Amusement and Recreation Services, N.E.C.	$58 M	$56 M	$57 M	$58 M	$50 M	$974 M	5.9%
Other State and Local Govt Enterprises	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.8%
Other Federal Government Enterprises	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.6%
Household Income	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4.9%
Total Outlay	$5,010 M	$4,913 M	$4,962 M	$4,995 M	$4,415 M	$82,995 M	6.0%
Percentage of Total SCAG Regional Economy	6.0%	5.9%	6.0%	6.0%	5.3%	100.0%	

APPENDIX G

SCAG REGION
DETAILED 55-SECTOR MODEL ECONOMIC IMPACTS
BY 2020 RTP FORECAST SCENARIO
FOR:
OUTPUT, INCOME, EMPLOYMENT, AND TAXES

LEVEL-1 RTP MEDIUM
SCAG REGION 2020 AIR TRANSPORTATION SERVICES IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$0 M	$11 M	$11 M	$3 M	$0 M	50
Agriculture	$0 M	$6 M	$6 M	$2 M	$0 M	61
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	0
Agricultural Services	$0 M	$8 M	$8 M	$5 M	$0 M	322
Mining	$0 M	$29 M	$29 M	$7 M	$2 M	137
Construction	$0 M	$189 M	$189 M	$78 M	$1 M	1,674
Food Processing	$0 M	$171 M	$171 M	$27 M	$4 M	365
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$16 M	$16 M	$4 M	$0 M	90
Apparel	$0 M	$26 M	$26 M	$7 M	$0 M	160
Wood Products	$0 M	$4 M	$4 M	$1 M	$0 M	33
Furniture	$0 M	$18 M	$18 M	$5 M	$0 M	107
Pulp and Paper	$0 M	$60 M	$60 M	$14 M	$1 M	174
Printing & Publishing	$0 M	$159 M	$159 M	$60 M	$2 M	1,114
Chemicals	$0 M	$92 M	$92 M	$18 M	$1 M	182
Petroleum & Coal Products	$0 M	$1,439 M	$1,439 M	$102 M	$51 M	438
Rubber Products	$0 M	$2 M	$2 M	$0 M	$0 M	5
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	51
Stone Clay & Glass Products	$0 M	$3 M	$3 M	$1 M	$0 M	10
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	2
Fabricated Metals	$0 M	$10 M	$10 M	$3 M	$0 M	35
Industrial Machinery	$0 M	$10 M	$10 M	$3 M	$0 M	34
Electrical Machinery	$0 M	$156 M	$156 M	$44 M	$1 M	457
Transportation Equipment	$0 M	$17 M	$17 M	$6 M	$0 M	47
Scientific Instruments	$0 M	$34 M	$34 M	$12 M	$0 M	87
Miscellaneous Manufacturing	$0 M	$38 M	$38 M	$11 M	$1 M	224
Railroads and Related Services	$0 M	$23 M	$23 M	$9 M	$1 M	84
Local, Interurban Passenger Transit	$0 M	$16 M	$16 M	$10 M	$0 M	363
Motor Freight Transport and Warehousing	$0 M	$126 M	$126 M	$41 M	$2 M	597
Water Transportation	$0 M	$44 M	$44 M	$12 M	$2 M	105
Air Transportation	$18,090 M	$367 M	$18,457 M	$7,721 M	$577 M	109,078
Other Transportation	$0 M	$1,168 M	$1,168 M	$762 M	$12 M	10,928
Communications & Public Utilities	$0 M	$635 M	$635 M	$146 M	$44 M	1,427
Wholesale Trade	$0 M	$592 M	$592 M	$240 M	$91 M	3,484
Other Retail Trade	$0 M	$1,690 M	$1,690 M	$289 M	$272 M	9,263
Eating & Drinking	$0 M	$361 M	$361 M	$139 M	$26 M	9,443
FIRE	$0 M	$1,569 M	$1,569 M	$233 M	$160 M	4,079
Hotels and Lodging Places	$0 M	$117 M	$117 M	$45 M	$8 M	1,562
Personal Services	$0 M	$76 M	$76 M	$36 M	$2 M	1,476
Business Services	$0 M	$933 M	$933 M	$529 M	$17 M	12,597
Automobile Rental and Leasing	$0 M	$29 M	$29 M	$8 M	$2 M	222
Auto Repair Services	$0 M	$102 M	$102 M	$37 M	$4 M	1,080
All Other Services	$0 M	$1,482 M	$1,482 M	$789 M	$16 M	15,940
Amusement and Recreation Services, N.E.C.	$0 M	$45 M	$45 M	$16 M	$2 M	636
Other State and Local Govt Enterprises	$0 M	$93 M	$93 M	$21 M	$0 M	379
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	27
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,451
Total Outlay	$18,090 M	$11,978 M	$30,068 M	$12,167 M	$1,304 M	191,080

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-2 RTP MEDIUM
SCAG REGION 2020 NON-RESIDENT AIR PASSENGER IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$27 M	$27 M	$7 M	$0 M	130
Agriculture	$0 M	$14 M	$14 M	$5 M	$0 M	137
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$28 M	$28 M	$17 M	$1 M	1,118
Mining	$0 M	$9 M	$9 M	$2 M	$1 M	41
Construction	$0 M	$362 M	$362 M	$149 M	$3 M	3,215
Food Processing	$0 M	$441 M	$441 M	$69 M	$10 M	941
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$18 M	$18 M	$4 M	$0 M	101
Apparel	$0 M	$34 M	$34 M	$9 M	$0 M	205
Wood Products	$0 M	$6 M	$6 M	$2 M	$0 M	52
Furniture	$0 M	$16 M	$16 M	$5 M	$0 M	96
Pulp and Paper	$0 M	$116 M	$116 M	$27 M	$1 M	334
Printing & Publishing	$0 M	$176 M	$176 M	$67 M	$2 M	1,239
Chemicals	$0 M	$108 M	$108 M	$22 M	$1 M	215
Petroleum & Coal Products	$0 M	$231 M	$231 M	$16 M	$8 M	70
Rubber Products	$0 M	$3 M	$3 M	$1 M	$0 M	8
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	50
Stone Clay & Glass Products	$0 M	$5 M	$5 M	$1 M	$0 M	17
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	3
Fabricated Metals	$0 M	$13 M	$13 M	$4 M	$0 M	47
Industrial Machinery	$0 M	$15 M	$15 M	$5 M	$0 M	50
Electrical Machinery	$0 M	$156 M	$156 M	$44 M	$1 M	457
Transportation Equipment	$0 M	$7 M	$7 M	$2 M	$0 M	19
Scientific Instruments	$0 M	$41 M	$41 M	$15 M	$0 M	108
Miscellaneous Manufacturing	$0 M	$44 M	$44 M	$13 M	$1 M	259
Railroads and Related Services	$0 M	$22 M	$22 M	$8 M	$1 M	78
Local, Interurban Passenger Transit	$384 M	$17 M	$401 M	$238 M	$5 M	7,042
Motor Freight Transport and Warehousing	$0 M	$176 M	$176 M	$57 M	$3 M	837
Water Transportation	$0 M	$21 M	$21 M	$6 M	$1 M	49
Air Transportation	$0 M	$55 M	$55 M	$23 M	$2 M	326
Other Transportation	$384 M	$213 M	$597 M	$389 M	$6 M	5,583
Communications & Public Utilities	$0 M	$869 M	$869 M	$200 M	$61 M	1,952
Wholesale Trade	$0 M	$687 M	$687 M	$279 M	$106 M	4,039
Other Retail Trade	$1,948 M	$5,564 M	$7,511 M	$1,286 M	$1,210 M	41,162
Eating & Drinking	$4,143 M	$270 M	$4,413 M	$1,694 M	$315 M	115,403
FIRE	$0 M	$2,167 M	$2,167 M	$322 M	$221 M	5,634
Hotels and Lodging Places	$6,147 M	$125 M	$6,272 M	$2,398 M	$408 M	83,754
Personal Services	$0 M	$122 M	$122 M	$58 M	$3 M	2,386
Business Services	$0 M	$1,018 M	$1,018 M	$577 M	$19 M	13,745
Automobile Rental and Leasing	$1,114 M	$47 M	$1,162 M	$329 M	$81 M	8,973
Auto Repair Services	$0 M	$132 M	$132 M	$48 M	$6 M	1,396
All Other Services	$868 M	$1,766 M	$2,634 M	$1,402 M	$29 M	28,332
Amusement and Recreation Services, N.E.C.	$1,100 M	$40 M	$1,140 M	$410 M	$53 M	16,191
Other State and Local Govt Enterprises	$0 M	$114 M	$114 M	$25 M	$0 M	466
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	28
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,182
Total Outlay	$16,087 M	$15,310 M	$31,397 M	$10,907 M	$2,559 M	348,471

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 AND LEVEL-2 RTP MEDIUM
SCAG REGION 2020 AIR SERVICESN AND NON-RESIDENT AIR PASSENGER IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$38 M	$38 M	$3 M	$0 M	181
Agriculture	$0 M	$20 M	$20 M	$2 M	$0 M	197
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	1
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$36 M	$36 M	$6 M	$1 M	1,439
Mining	$0 M	$37 M	$37 M	$7 M	$2 M	178
Construction	$0 M	$551 M	$551 M	$80 M	$4 M	4,889
Food Processing	$0 M	$612 M	$612 M	$37 M	$14 M	1,305
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$34 M	$34 M	$4 M	$0 M	191
Apparel	$0 M	$60 M	$60 M	$7 M	$0 M	365
Wood Products	$0 M	$10 M	$10 M	$1 M	$0 M	86
Furniture	$0 M	$34 M	$34 M	$5 M	$0 M	203
Pulp and Paper	$0 M	$176 M	$176 M	$15 M	$2 M	509
Printing & Publishing	$0 M	$335 M	$335 M	$62 M	$4 M	2,353
Chemicals	$0 M	$200 M	$200 M	$19 M	$2 M	397
Petroleum & Coal Products	$0 M	$1,670 M	$1,670 M	$110 M	$59 M	508
Rubber Products	$0 M	$4 M	$4 M	$0 M	$0 M	13
Leather Products	$0 M	$10 M	$10 M	$2 M	$0 M	101
Stone Clay & Glass Products	$0 M	$8 M	$8 M	$1 M	$0 M	27
Primary Metals	$0 M	$2 M	$2 M	$0 M	$0 M	5
Fabricated Metals	$0 M	$22 M	$22 M	$3 M	$0 M	81
Industrial Machinery	$0 M	$24 M	$24 M	$3 M	$0 M	83
Electrical Machinery	$0 M	$313 M	$313 M	$45 M	$3 M	914
Transportation Equipment	$0 M	$24 M	$24 M	$6 M	$0 M	66
Scientific Instruments	$0 M	$75 M	$75 M	$12 M	$1 M	195
Miscellaneous Manufacturing	$0 M	$82 M	$82 M	$12 M	$1 M	483
Railroads and Related Services	$0 M	$45 M	$45 M	$10 M	$1 M	163
Local, Interurban Passenger Transit	$384 M	$33 M	$417 M	$15 M	$5 M	7,404
Motor Freight Transport and Warehousing	$0 M	$302 M	$302 M	$44 M	$5 M	1,434
Water Transportation	$0 M	$65 M	$65 M	$13 M	$2 M	154
Air Transportation	$18,090 M	$422 M	$18,512 M	$7,722 M	$579 M	109,404
Other Transportation	$384 M	$1,382 M	$1,765 M	$768 M	$18 M	16,511
Communications & Public Utilities	$0 M	$1,504 M	$1,504 M	$207 M	$105 M	3,379
Wholesale Trade	$0 M	$1,279 M	$1,279 M	$346 M	$197 M	7,523
Other Retail Trade	$1,948 M	$7,254 M	$9,202 M	$1,499 M	$1,482 M	50,425
Eating & Drinking	$4,143 M	$631 M	$4,774 M	$453 M	$341 M	124,846
FIRE	$0 M	$3,735 M	$3,735 M	$454 M	$380 M	9,713
Hotels and Lodging Places	$6,147 M	$242 M	$6,389 M	$452 M	$415 M	85,316
Personal Services	$0 M	$198 M	$198 M	$39 M	$6 M	3,862
Business Services	$0 M	$1,950 M	$1,950 M	$548 M	$36 M	26,342
Automobile Rental and Leasing	$1,114 M	$76 M	$1,190 M	$89 M	$83 M	9,195
Auto Repair Services	$0 M	$235 M	$235 M	$43 M	$10 M	2,476
All Other Services	$868 M	$3,248 M	$4,116 M	$818 M	$46 M	44,272
Amusement and Recreation Services, N.E.C.	$1,100 M	$85 M	$1,185 M	$70 M	$56 M	16,827
Other State and Local Govt Enterprises	$0 M	$207 M	$207 M	$21 M	$0 M	845
Other Federal Government Enterprises	$0 M	$14 M	$14 M	$2 M	$0 M	55
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	4,632
Total Outlay	$34,177 M	$27,287 M	$61,465 M	$14,725 M	$3,863 M	539,551

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-3 RTP MEDIUM
SCAG REGION 2020 AIR CARGO IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$17 M	$12 M	$29 M	$7 M	$0 M	138
Agriculture	$18 M	$10 M	$27 M	$9 M	$1 M	269
Forestry & Forest Products	$1 M	$0 M	$1 M	$0 M	$0 M	5
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	225
Agricultural Services	$0 M	$16 M	$16 M	$10 M	$0 M	654
Mining	$0 M	$20 M	$20 M	$5 M	$1 M	94
Construction	$0 M	$310 M	$310 M	$128 M	$2 M	2,754
Food Processing	$23 M	$166 M	$189 M	$30 M	$4 M	403
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$42 M	$236 M	$278 M	$67 M	$2 M	1,563
Apparel	$1,142 M	$81 M	$1,223 M	$315 M	$5 M	7,460
Wood Products	$3 M	$13 M	$17 M	$6 M	$0 M	145
Furniture	$137 M	$77 M	$214 M	$62 M	$1 M	1,272
Pulp and Paper	$23 M	$236 M	$259 M	$60 M	$3 M	747
Printing & Publishing	$150 M	$169 M	$320 M	$122 M	$4 M	2,247
Chemicals	$362 M	$335 M	$697 M	$139 M	$7 M	1,380
Petroleum & Coal Products	$9 M	$211 M	$220 M	$16 M	$8 M	67
Rubber Products	$179 M	$11 M	$190 M	$44 M	$1 M	575
Leather Products	$12 M	$8 M	$20 M	$7 M	$0 M	199
Stone Clay & Glass Products	$71 M	$11 M	$82 M	$24 M	$1 M	294
Primary Metals	$309 M	$44 M	$353 M	$72 M	$4 M	775
Fabricated Metals	$353 M	$139 M	$492 M	$147 M	$5 M	1,783
Industrial Machinery	$1,284 M	$125 M	$1,409 M	$438 M	$11 M	4,805
Electrical Machinery	$7,165 M	$2,312 M	$9,477 M	$2,659 M	$80 M	27,686
Transportation Equipment	$4,528 M	$40 M	$4,568 M	$1,566 M	$43 M	12,419
Scientific Instruments	$4,734 M	$317 M	$5,051 M	$1,779 M	$35 M	13,157
Miscellaneous Manufacturing	$564 M	$66 M	$630 M	$189 M	$11 M	3,706
Railroads and Related Services	$0 M	$47 M	$47 M	$18 M	$1 M	167
Local, Interurban Passenger Transit	$0 M	$21 M	$21 M	$13 M	$0 M	476
Motor Freight Transport and Warehousing	$0 M	$302 M	$302 M	$98 M	$5 M	1,434
Water Transportation	$0 M	$25 M	$25 M	$7 M	$1 M	60
Air Transportation	$0 M	$81 M	$81 M	$34 M	$3 M	479
Other Transportation	$0 M	$122 M	$122 M	$79 M	$1 M	1,139
Communications & Public Utilities	$0 M	$743 M	$743 M	$171 M	$52 M	1,668
Wholesale Trade	$0 M	$2,014 M	$2,014 M	$817 M	$310 M	11,846
Other Retail Trade	$0 M	$1,764 M	$1,764 M	$302 M	$284 M	9,665
Eating & Drinking	$0 M	$294 M	$294 M	$113 M	$21 M	7,682
FIRE	$0 M	$1,706 M	$1,706 M	$254 M	$174 M	4,437
Hotels and Lodging Places	$0 M	$175 M	$175 M	$67 M	$11 M	2,342
Personal Services	$0 M	$87 M	$87 M	$41 M	$2 M	1,696
Business Services	$0 M	$971 M	$971 M	$550 M	$18 M	13,110
Automobile Rental and Leasing	$0 M	$40 M	$40 M	$11 M	$3 M	310
Auto Repair Services	$0 M	$198 M	$198 M	$72 M	$8 M	2,085
All Other Services	$0 M	$1,831 M	$1,831 M	$975 M	$20 M	19,695
Amusement and Recreation Services, N.E.C.	$0 M	$45 M	$45 M	$16 M	$2 M	640
Other State and Local Govt Enterprises	$0 M	$119 M	$119 M	$27 M	$0 M	487
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	27
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,467
Total Outlay	$21,142 M	$15,558 M	$36,700 M	$12,243 M	$1,147 M	166,736

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1, LEVEL-2, AND LEVEL-3 RTP MEDIUM
COMBINED SCAG REGION 2020 AIR TRANSPORTATION SERVICES, NON-RESIDENT AIR PASSENGER IMPACTS, AND AIR CARGO IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$17 M	$50 M	$67 M	$10 M	$1 M	319
Agriculture	$18 M	$30 M	$47 M	$12 M	$1 M	466
Forestry & Forest Products	$1 M	$1 M	$1 M	$0 M	$0 M	6
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	227
Agricultural Services	$0 M	$52 M	$52 M	$16 M	$2 M	2,093
Mining	$0 M	$57 M	$57 M	$12 M	$4 M	273
Construction	$0 M	$861 M	$861 M	$208 M	$7 M	7,643
Food Processing	$23 M	$778 M	$801 M	$67 M	$19 M	1,709
Tobacco	$0 M	$1 M	$1 M	$0 M	$0 M	1
Textiles	$42 M	$270 M	$312 M	$71 M	$2 M	1,753
Apparel	$1,142 M	$140 M	$1,283 M	$322 M	$5 M	7,825
Wood Products	$3 M	$23 M	$26 M	$7 M	$0 M	230
Furniture	$137 M	$111 M	$248 M	$68 M	$1 M	1,475
Pulp and Paper	$23 M	$412 M	$435 M	$75 M	$5 M	1,256
Printing & Publishing	$150 M	$504 M	$655 M	$184 M	$7 M	4,600
Chemicals	$362 M	$535 M	$897 M	$159 M	$9 M	1,777
Petroleum & Coal Products	$9 M	$1,881 M	$1,890 M	$126 M	$67 M	575
Rubber Products	$179 M	$15 M	$194 M	$45 M	$1 M	588
Leather Products	$12 M	$18 M	$30 M	$8 M	$0 M	300
Stone Clay & Glass Products	$71 M	$19 M	$90 M	$25 M	$1 M	321
Primary Metals	$309 M	$46 M	$355 M	$72 M	$4 M	780
Fabricated Metals	$353 M	$161 M	$514 M	$150 M	$5 M	1,865
Industrial Machinery	$1,284 M	$150 M	$1,434 M	$441 M	$11 M	4,888
Electrical Machinery	$7,165 M	$2,625 M	$9,790 M	$2,705 M	$82 M	28,600
Transportation Equipment	$4,528 M	$64 M	$4,593 M	$1,572 M	$43 M	12,485
Scientific Instruments	$4,734 M	$392 M	$5,126 M	$1,791 M	$35 M	13,352
Miscellaneous Manufacturing	$564 M	$148 M	$712 M	$201 M	$13 M	4,189
Railroads and Related Services	$0 M	$92 M	$92 M	$28 M	$2 M	330
Local, Interurban Passenger Transit	$384 M	$55 M	$438 M	$27 M	$5 M	7,881
Motor Freight Transport and Warehousing	$0 M	$604 M	$604 M	$141 M	$9 M	2,868
Water Transportation	$0 M	$90 M	$90 M	$20 M	$3 M	215
Air Transportation	$18,090 M	$503 M	$18,593 M	$7,756 M	$581 M	109,883
Other Transportation	$384 M	$1,504 M	$1,887 M	$847 M	$20 M	17,650
Communications & Public Utilities	$0 M	$2,246 M	$2,246 M	$378 M	$157 M	5,047
Wholesale Trade	$0 M	$3,294 M	$3,294 M	$1,163 M	$507 M	19,369
Other Retail Trade	$1,948 M	$9,018 M	$10,965 M	$1,801 M	$1,766 M	60,090
Eating & Drinking	$4,143 M	$925 M	$5,068 M	$566 M	$362 M	132,528
FIRE	$0 M	$5,442 M	$5,442 M	$708 M	$554 M	14,150
Hotels and Lodging Places	$6,147 M	$418 M	$6,565 M	$519 M	$426 M	87,658
Personal Services	$0 M	$285 M	$285 M	$80 M	$8 M	5,558
Business Services	$0 M	$2,921 M	$2,921 M	$1,098 M	$54 M	39,452
Automobile Rental and Leasing	$1,114 M	$116 M	$1,230 M	$101 M	$86 M	9,506
Auto Repair Services	$0 M	$432 M	$432 M	$114 M	$18 M	4,561
All Other Services	$868 M	$5,080 M	$5,948 M	$1,793 M	$66 M	63,967
Amusement and Recreation Services, N.E.C.	$1,100 M	$130 M	$1,230 M	$86 M	$58 M	17,467
Other State and Local Govt Enterprises	$0 M	$326 M	$326 M	$47 M	$0 M	1,332
Other Federal Government Enterprises	$0 M	$21 M	$21 M	$4 M	$0 M	82
Household Income*	$0 M	$0 M	$0 M	$1,335 M	$0 M	7,099
Total Outlay	$55,320 M	$42,845 M	$98,165 M	$26,968 M	$5,010 M	706,287

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 SCENARIO 2C HSR
SCAG REGION 2020 AIR TRANSPORTATION SERVICES IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$0 M	$10 M	$10 M	$3 M	$0 M	50
Agriculture	$0 M	$6 M	$6 M	$2 M	$0 M	60
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	0
Agricultural Services	$0 M	$8 M	$8 M	$5 M	$0 M	319
Mining	$0 M	$28 M	$28 M	$7 M	$2 M	136
Construction	$0 M	$187 M	$187 M	$77 M	$1 M	1,660
Food Processing	$0 M	$169 M	$169 M	$27 M	$4 M	362
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$16 M	$16 M	$4 M	$0 M	89
Apparel	$0 M	$26 M	$26 M	$7 M	$0 M	159
Wood Products	$0 M	$4 M	$4 M	$1 M	$0 M	33
Furniture	$0 M	$18 M	$18 M	$5 M	$0 M	106
Pulp and Paper	$0 M	$60 M	$60 M	$14 M	$1 M	173
Printing & Publishing	$0 M	$157 M	$157 M	$60 M	$2 M	1,105
Chemicals	$0 M	$91 M	$91 M	$18 M	$1 M	180
Petroleum & Coal Products	$0 M	$1,426 M	$1,426 M	$101 M	$51 M	434
Rubber Products	$0 M	$2 M	$2 M	$0 M	$0 M	5
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	50
Stone Clay & Glass Products	$0 M	$3 M	$3 M	$1 M	$0 M	10
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	2
Fabricated Metals	$0 M	$9 M	$9 M	$3 M	$0 M	34
Industrial Machinery	$0 M	$10 M	$10 M	$3 M	$0 M	33
Electrical Machinery	$0 M	$155 M	$155 M	$44 M	$1 M	453
Transportation Equipment	$0 M	$17 M	$17 M	$6 M	$0 M	47
Scientific Instruments	$0 M	$33 M	$33 M	$12 M	$0 M	87
Miscellaneous Manufacturing	$0 M	$38 M	$38 M	$11 M	$1 M	222
Railroads and Related Services	$0 M	$23 M	$23 M	$9 M	$1 M	84
Local, Interurban Passenger Transit	$0 M	$16 M	$16 M	$10 M	$0 M	360
Motor Freight Transport and Warehousing	$0 M	$125 M	$125 M	$40 M	$2 M	592
Water Transportation	$0 M	$44 M	$44 M	$12 M	$2 M	104
Air Transportation	$17,938 M	$364 M	$18,302 M	$7,656 M	$572 M	108,163
Other Transportation	$0 M	$1,159 M	$1,159 M	$755 M	$12 M	10,836
Communications & Public Utilities	$0 M	$630 M	$630 M	$145 M	$44 M	1,415
Wholesale Trade	$0 M	$587 M	$587 M	$238 M	$90 M	3,455
Other Retail Trade	$0 M	$1,676 M	$1,676 M	$287 M	$270 M	9,185
Eating & Drinking	$0 M	$358 M	$358 M	$137 M	$26 M	9,364
FIRE	$0 M	$1,555 M	$1,555 M	$231 M	$158 M	4,044
Hotels and Lodging Places	$0 M	$116 M	$116 M	$44 M	$8 M	1,549
Personal Services	$0 M	$75 M	$75 M	$35 M	$2 M	1,464
Business Services	$0 M	$925 M	$925 M	$524 M	$17 M	12,491
Automobile Rental and Leasing	$0 M	$29 M	$29 M	$8 M	$2 M	220
Auto Repair Services	$0 M	$101 M	$101 M	$37 M	$4 M	1,071
All Other Services	$0 M	$1,470 M	$1,470 M	$782 M	$16 M	15,806
Amusement and Recreation Services, N.E.C.	$0 M	$44 M	$44 M	$16 M	$2 M	631
Other State and Local Govt Enterprises	$0 M	$92 M	$92 M	$21 M	$0 M	376
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	27
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,430
Total Outlay	$17,938 M	$11,877 M	$29,815 M	$12,070 M	$1,293 M	189,476

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-2 SCENARIO 2C HSR
SCAG REGION 2020 NON-RESIDENT AIR PASSENGER IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$0 M	$27 M	$27 M	$7 M	$0 M	127
Agriculture	$0 M	$13 M	$13 M	$5 M	$0 M	133
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$27 M	$27 M	$17 M	$1 M	1,088
Mining	$0 M	$8 M	$8 M	$2 M	$1 M	40
Construction	$0 M	$353 M	$353 M	$145 M	$3 M	3,129
Food Processing	$0 M	$428 M	$428 M	$67 M	$10 M	914
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$18 M	$18 M	$4 M	$0 M	98
Apparel	$0 M	$33 M	$33 M	$8 M	$0 M	200
Wood Products	$0 M	$6 M	$6 M	$2 M	$0 M	51
Furniture	$0 M	$16 M	$16 M	$5 M	$0 M	94
Pulp and Paper	$0 M	$113 M	$113 M	$26 M	$1 M	325
Printing & Publishing	$0 M	$172 M	$172 M	$65 M	$2 M	1,205
Chemicals	$0 M	$105 M	$105 M	$21 M	$1 M	209
Petroleum & Coal Products	$0 M	$225 M	$225 M	$16 M	$8 M	69
Rubber Products	$0 M	$3 M	$3 M	$1 M	$0 M	8
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	49
Stone Clay & Glass Products	$0 M	$5 M	$5 M	$1 M	$0 M	17
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	3
Fabricated Metals	$0 M	$13 M	$13 M	$4 M	$0 M	45
Industrial Machinery	$0 M	$14 M	$14 M	$4 M	$0 M	48
Electrical Machinery	$0 M	$152 M	$152 M	$43 M	$1 M	445
Transportation Equipment	$0 M	$7 M	$7 M	$2 M	$0 M	18
Scientific Instruments	$0 M	$40 M	$40 M	$14 M	$0 M	105
Miscellaneous Manufacturing	$0 M	$43 M	$43 M	$13 M	$1 M	252
Railroads and Related Services	$0 M	$21 M	$21 M	$8 M	$1 M	76
Local, Interurban Passenger Transit	$373 M	$17 M	$389 M	$232 M	$5 M	6,843
Motor Freight Transport and Warehousing	$0 M	$171 M	$171 M	$56 M	$3 M	814
Water Transportation	$0 M	$20 M	$20 M	$6 M	$1 M	48
Air Transportation	$0 M	$54 M	$54 M	$22 M	$2 M	317
Other Transportation	$373 M	$208 M	$581 M	$379 M	$6 M	5,430
Communications & Public Utilities	$0 M	$845 M	$845 M	$194 M	$59 M	1,900
Wholesale Trade	$0 M	$668 M	$668 M	$271 M	$103 M	3,929
Other Retail Trade	$1,878 M	$5,378 M	$7,256 M	$1,242 M	$1,168 M	39,764
Eating & Drinking	$4,025 M	$263 M	$4,288 M	$1,646 M	$306 M	112,131
FIRE	$0 M	$2,109 M	$2,109 M	$314 M	$215 M	5,483
Hotels and Lodging Places	$5,996 M	$122 M	$6,118 M	$2,339 M	$397 M	81,696
Personal Services	$0 M	$119 M	$119 M	$56 M	$3 M	2,322
Business Services	$0 M	$990 M	$990 M	$561 M	$18 M	13,371
Automobile Rental and Leasing	$1,096 M	$46 M	$1,142 M	$324 M	$80 M	8,823
Auto Repair Services	$0 M	$129 M	$129 M	$47 M	$5 M	1,359
All Other Services	$842 M	$1,718 M	$2,560 M	$1,363 M	$28 M	27,534
Amusement and Recreation Services, N.E.C.	$1,066 M	$39 M	$1,105 M	$397 M	$52 M	15,691
Other State and Local Govt Enterprises	$0 M	$111 M	$111 M	$25 M	$0 M	454
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	27
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,122
Total Outlay	$15,649 M	$14,861 M	$30,510 M	$10,625 M	$2,482 M	338,808

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 AND LEVEL-2 SCENARIO 2C HSR
SCAG REGION 2020 AIR SERVICESN AND NON-RESIDENT AIR PASSENGER IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$37 M	$37 M	$9 M	$0 M	177
Agriculture	$0 M	$20 M	$20 M	$7 M	$0 M	193
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	1
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$35 M	$35 M	$22 M	$1 M	1,407
Mining	$0 M	$37 M	$37 M	$9 M	$2 M	176
Construction	$0 M	$540 M	$540 M	$222 M	$4 M	4,789
Food Processing	$0 M	$598 M	$598 M	$94 M	$14 M	1,276
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$33 M	$33 M	$8 M	$0 M	187
Apparel	$0 M	$59 M	$59 M	$15 M	$0 M	358
Wood Products	$0 M	$10 M	$10 M	$3 M	$0 M	84
Furniture	$0 M	$34 M	$34 M	$10 M	$0 M	199
Pulp and Paper	$0 M	$173 M	$173 M	$40 M	$2 M	498
Printing & Publishing	$0 M	$329 M	$329 M	$125 M	$4 M	2,310
Chemicals	$0 M	$196 M	$196 M	$39 M	$2 M	389
Petroleum & Coal Products	$0 M	$1,652 M	$1,652 M	$117 M	$59 M	502
Rubber Products	$0 M	$4 M	$4 M	$1 M	$0 M	13
Leather Products	$0 M	$10 M	$10 M	$3 M	$0 M	99
Stone Clay & Glass Products	$0 M	$8 M	$8 M	$2 M	$0 M	27
Primary Metals	$0 M	$2 M	$2 M	$0 M	$0 M	5
Fabricated Metals	$0 M	$22 M	$22 M	$7 M	$0 M	80
Industrial Machinery	$0 M	$24 M	$24 M	$7 M	$0 M	82
Electrical Machinery	$0 M	$307 M	$307 M	$86 M	$3 M	898
Transportation Equipment	$0 M	$24 M	$24 M	$8 M	$0 M	65
Scientific Instruments	$0 M	$73 M	$73 M	$26 M	$1 M	191
Miscellaneous Manufacturing	$0 M	$81 M	$81 M	$24 M	$1 M	474
Railroads and Related Services	$0 M	$44 M	$44 M	$17 M	$1 M	160
Local, Interurban Passenger Transit	$373 M	$33 M	$405 M	$241 M	$5 M	7,202
Motor Freight Transport and Warehousing	$0 M	$296 M	$296 M	$96 M	$5 M	1,407
Water Transportation	$0 M	$64 M	$64 M	$18 M	$2 M	152
Air Transportation	$17,938 M	$417 M	$18,355 M	$7,678 M	$574 M	108,479
Other Transportation	$373 M	$1,367 M	$1,739 M	$1,134 M	$18 M	16,266
Communications & Public Utilities	$0 M	$1,475 M	$1,475 M	$339 M	$103 M	3,314
Wholesale Trade	$0 M	$1,256 M	$1,256 M	$509 M	$193 M	7,384
Other Retail Trade	$1,878 M	$7,054 M	$8,932 M	$1,529 M	$1,438 M	48,949
Eating & Drinking	$4,025 M	$621 M	$4,646 M	$1,783 M	$332 M	121,495
FIRE	$0 M	$3,664 M	$3,664 M	$545 M	$373 M	9,527
Hotels and Lodging Places	$5,996 M	$238 M	$6,234 M	$2,384 M	$405 M	83,245
Personal Services	$0 M	$194 M	$194 M	$91 M	$5 M	3,786
Business Services	$0 M	$1,915 M	$1,915 M	$1,085 M	$36 M	25,862
Automobile Rental and Leasing	$1,096 M	$75 M	$1,171 M	$332 M	$82 M	9,044
Auto Repair Services	$0 M	$230 M	$230 M	$83 M	$10 M	2,430
All Other Services	$842 M	$3,188 M	$4,030 M	$2,145 M	$45 M	43,340
Amusement and Recreation Services, N.E.C.	$1,066 M	$83 M	$1,149 M	$413 M	$54 M	16,322
Other State and Local Govt Enterprises	$0 M	$203 M	$203 M	$45 M	$0 M	829
Other Federal Government Enterprises	$0 M	$14 M	$14 M	$4 M	$0 M	54
Household Income*	$0 M	$0 M	$0 M	$1,335 M	$0 M	4,552
Total Outlay	$33,587 M	$26,738 M	$60,325 M	$22,695 M	$3,776 M	528,284

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-3 SCENARIO 2C HSR
SCAG REGION 2020 AIR CARGO IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$16 M	$12 M	$29 M	$7 M	$0 M	137
Agriculture	$17 M	$9 M	$27 M	$9 M	$1 M	266
Forestry & Forest Products	$1 M	$0 M	$1 M	$0 M	$0 M	5
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	223
Agricultural Services	$0 M	$16 M	$16 M	$10 M	$0 M	649
Mining	$0 M	$19 M	$20 M	$5 M	$1 M	94
Construction	$0 M	$308 M	$308 M	$127 M	$2 M	2,731
Food Processing	$23 M	$165 M	$187 M	$29 M	$4 M	400
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$42 M	$234 M	$276 M	$66 M	$2 M	1,549
Apparel	$1,133 M	$80 M	$1,213 M	$313 M	$5 M	7,398
Wood Products	$3 M	$13 M	$16 M	$6 M	$0 M	143
Furniture	$135 M	$77 M	$212 M	$62 M	$1 M	1,262
Pulp and Paper	$23 M	$234 M	$257 M	$60 M	$3 M	741
Printing & Publishing	$149 M	$168 M	$317 M	$121 M	$4 M	2,228
Chemicals	$359 M	$332 M	$691 M	$138 M	$7 M	1,369
Petroleum & Coal Products	$8 M	$210 M	$218 M	$15 M	$8 M	66
Rubber Products	$177 M	$11 M	$188 M	$44 M	$1 M	570
Leather Products	$12 M	$8 M	$20 M	$6 M	$0 M	197
Stone Clay & Glass Products	$70 M	$11 M	$82 M	$24 M	$1 M	291
Primary Metals	$306 M	$44 M	$350 M	$71 M	$4 M	768
Fabricated Metals	$350 M	$138 M	$488 M	$145 M	$5 M	1,768
Industrial Machinery	$1,273 M	$124 M	$1,398 M	$434 M	$11 M	4,765
Electrical Machinery	$7,105 M	$2,293 M	$9,397 M	$2,637 M	$79 M	27,454
Transportation Equipment	$4,490 M	$40 M	$4,530 M	$1,553 M	$42 M	12,314
Scientific Instruments	$4,694 M	$314 M	$5,009 M	$1,764 M	$34 M	13,046
Miscellaneous Manufacturing	$559 M	$65 M	$625 M	$188 M	$11 M	3,675
Railroads and Related Services	$0 M	$46 M	$46 M	$18 M	$1 M	166
Local, Interurban Passenger Transit	$0 M	$21 M	$21 M	$13 M	$0 M	472
Motor Freight Transport and Warehousing	$0 M	$299 M	$299 M	$97 M	$5 M	1,422
Water Transportation	$0 M	$25 M	$25 M	$7 M	$1 M	60
Air Transportation	$0 M	$80 M	$80 M	$34 M	$3 M	475
Other Transportation	$0 M	$121 M	$121 M	$79 M	$1 M	1,129
Communications & Public Utilities	$0 M	$736 M	$736 M	$169 M	$52 M	1,654
Wholesale Trade	$0 M	$1,997 M	$1,997 M	$810 M	$308 M	11,747
Other Retail Trade	$0 M	$1,749 M	$1,749 M	$299 M	$282 M	9,584
Eating & Drinking	$0 M	$291 M	$291 M	$112 M	$21 M	7,618
FIRE	$0 M	$1,692 M	$1,692 M	$252 M	$172 M	4,400
Hotels and Lodging Places	$0 M	$174 M	$174 M	$66 M	$11 M	2,322
Personal Services	$0 M	$86 M	$86 M	$41 M	$2 M	1,682
Business Services	$0 M	$962 M	$962 M	$546 M	$18 M	13,000
Automobile Rental and Leasing	$0 M	$40 M	$40 M	$11 M	$3 M	308
Auto Repair Services	$0 M	$196 M	$196 M	$71 M	$8 M	2,067
All Other Services	$0 M	$1,816 M	$1,816 M	$967 M	$20 M	19,529
Amusement and Recreation Services, N.E.C.	$0 M	$45 M	$45 M	$16 M	$2 M	635
Other State and Local Govt Enterprises	$0 M	$118 M	$118 M	$26 M	$0 M	483
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	26
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,446
Total Outlay	$20,965 M	$15,427 M	$36,392 M	$12,146 M	$1,137 M	165,336

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

**LEVEL-1, LEVEL-2, AND LEVEL-3 SCENARIO 2C HSR
COMBINED SCAG REGION 2020 AIR TRANSPORTATION SERVICES, NON-RESIDENT AIR PASSENGER IMPACTS, AND AIR CARGO IMPACTS**

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$16 M	$49 M	$66 M	$17 M	$1 M	314
Agriculture	$17 M	$29 M	$46 M	$16 M	$1 M	459
Forestry & Forest Products	$1 M	$1 M	$1 M	$0 M	$0 M	6
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	225
Agricultural Services	$0 M	$51 M	$51 M	$32 M	$1 M	2,056
Mining	$0 M	$56 M	$56 M	$13 M	$3 M	269
Construction	$0 M	$848 M	$848 M	$348 M	$7 M	7,520
Food Processing	$23 M	$763 M	$785 M	$123 M	$18 M	1,676
Tobacco	$0 M	$1 M	$1 M	$0 M	$0 M	1
Textiles	$42 M	$268 M	$309 M	$74 M	$2 M	1,737
Apparel	$1,133 M	$139 M	$1,271 M	$328 M	$5 M	7,756
Wood Products	$3 M	$23 M	$26 M	$9 M	$0 M	227
Furniture	$135 M	$110 M	$246 M	$72 M	$1 M	1,461
Pulp and Paper	$23 M	$406 M	$429 M	$100 M	$5 M	1,239
Printing & Publishing	$149 M	$497 M	$646 M	$246 M	$7 M	4,538
Chemicals	$359 M	$528 M	$887 M	$177 M	$9 M	1,758
Petroleum & Coal Products	$8 M	$1,861 M	$1,870 M	$133 M	$67 M	569
Rubber Products	$177 M	$15 M	$192 M	$45 M	$1 M	583
Leather Products	$12 M	$18 M	$30 M	$10 M	$0 M	296
Stone Clay & Glass Products	$70 M	$19 M	$89 M	$26 M	$1 M	318
Primary Metals	$306 M	$46 M	$352 M	$72 M	$4 M	773
Fabricated Metals	$350 M	$160 M	$510 M	$152 M	$5 M	1,848
Industrial Machinery	$1,273 M	$148 M	$1,422 M	$441 M	$11 M	4,846
Electrical Machinery	$7,105 M	$2,600 M	$9,705 M	$2,723 M	$82 M	28,351
Transportation Equipment	$4,490 M	$64 M	$4,554 M	$1,561 M	$43 M	12,380
Scientific Instruments	$4,694 M	$388 M	$5,082 M	$1,790 M	$35 M	13,238
Miscellaneous Manufacturing	$559 M	$146 M	$705 M	$212 M	$13 M	4,149
Railroads and Related Services	$0 M	$91 M	$91 M	$35 M	$2 M	326
Local, Interurban Passenger Transit	$373 M	$54 M	$426 M	$254 M	$5 M	7,675
Motor Freight Transport and Warehousing	$0 M	$595 M	$595 M	$193 M	$9 M	2,828
Water Transportation	$0 M	$89 M	$89 M	$25 M	$3 M	212
Air Transportation	$17,938 M	$498 M	$18,436 M	$7,712 M	$576 M	108,955
Other Transportation	$373 M	$1,487 M	$1,860 M	$1,213 M	$19 M	17,395
Communications & Public Utilities	$0 M	$2,211 M	$2,211 M	$509 M	$155 M	4,969
Wholesale Trade	$0 M	$3,253 M	$3,253 M	$1,320 M	$501 M	19,131
Other Retail Trade	$1,878 M	$8,803 M	$10,681 M	$1,828 M	$1,720 M	58,533
Eating & Drinking	$4,025 M	$912 M	$4,937 M	$1,895 M	$352 M	129,113
FIRE	$0 M	$5,356 M	$5,356 M	$797 M	$545 M	13,927
Hotels and Lodging Places	$5,996 M	$412 M	$6,408 M	$2,450 M	$416 M	85,568
Personal Services	$0 M	$281 M	$281 M	$132 M	$8 M	5,468
Business Services	$0 M	$2,877 M	$2,877 M	$1,631 M	$53 M	38,862
Automobile Rental and Leasing	$1,096 M	$115 M	$1,211 M	$343 M	$85 M	9,351
Auto Repair Services	$0 M	$426 M	$426 M	$154 M	$18 M	4,498
All Other Services	$842 M	$5,004 M	$5,846 M	$3,112 M	$65 M	62,870
Amusement and Recreation Services, N.E.C.	$1,066 M	$128 M	$1,194 M	$429 M	$56 M	16,957
Other State and Local Govt Enterprises	$0 M	$322 M	$322 M	$72 M	$0 M	1,312
Other Federal Government Enterprises	$0 M	$21 M	$21 M	$6 M	$0 M	81
Household Income*	$0 M	$0 M	$0 M	$2,002 M	$0 M	6,998
Total Outlay	$54,552 M	$42,166 M	$96,718 M	$34,841 M	$4,913 M	693,620

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 SCENARIO #8
SCAG REGION 2020 AIR TRANSPORTATION SERVICES IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$0 M	$11 M	$11 M	$3 M	$0 M	50
Agriculture	$0 M	$6 M	$6 M	$2 M	$0 M	60
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	0
Agricultural Services	$0 M	$8 M	$8 M	$5 M	$0 M	320
Mining	$0 M	$29 M	$29 M	$7 M	$2 M	136
Construction	$0 M	$188 M	$188 M	$77 M	$1 M	1,664
Food Processing	$0 M	$170 M	$170 M	$27 M	$4 M	362
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$16 M	$16 M	$4 M	$0 M	89
Apparel	$0 M	$26 M	$26 M	$7 M	$0 M	159
Wood Products	$0 M	$4 M	$4 M	$1 M	$0 M	33
Furniture	$0 M	$18 M	$18 M	$5 M	$0 M	106
Pulp and Paper	$0 M	$60 M	$60 M	$14 M	$1 M	173
Printing & Publishing	$0 M	$158 M	$158 M	$60 M	$2 M	1,108
Chemicals	$0 M	$91 M	$91 M	$18 M	$1 M	181
Petroleum & Coal Products	$0 M	$1,430 M	$1,430 M	$102 M	$51 M	435
Rubber Products	$0 M	$2 M	$2 M	$0 M	$0 M	5
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	50
Stone Clay & Glass Products	$0 M	$3 M	$3 M	$1 M	$0 M	10
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	2
Fabricated Metals	$0 M	$9 M	$9 M	$3 M	$0 M	34
Industrial Machinery	$0 M	$10 M	$10 M	$3 M	$0 M	33
Electrical Machinery	$0 M	$155 M	$155 M	$44 M	$1 M	454
Transportation Equipment	$0 M	$17 M	$17 M	$6 M	$0 M	47
Scientific Instruments	$0 M	$33 M	$33 M	$12 M	$0 M	87
Miscellaneous Manufacturing	$0 M	$38 M	$38 M	$11 M	$1 M	222
Railroads and Related Services	$0 M	$23 M	$23 M	$9 M	$1 M	84
Local, Interurban Passenger Transit	$0 M	$16 M	$16 M	$10 M	$0 M	360
Motor Freight Transport and Warehousing	$0 M	$125 M	$125 M	$41 M	$2 M	594
Water Transportation	$0 M	$44 M	$44 M	$12 M	$2 M	105
Air Transportation	$17,982 M	$365 M	$18,346 M	$7,674 M	$574 M	108,426
Other Transportation	$0 M	$1,161 M	$1,161 M	$757 M	$12 M	10,862
Communications & Public Utilities	$0 M	$631 M	$631 M	$145 M	$44 M	1,418
Wholesale Trade	$0 M	$589 M	$589 M	$239 M	$91 M	3,463
Other Retail Trade	$0 M	$1,680 M	$1,680 M	$288 M	$271 M	9,207
Eating & Drinking	$0 M	$359 M	$359 M	$138 M	$26 M	9,387
FIRE	$0 M	$1,559 M	$1,559 M	$232 M	$159 M	4,054
Hotels and Lodging Places	$0 M	$116 M	$116 M	$44 M	$8 M	1,553
Personal Services	$0 M	$75 M	$75 M	$35 M	$2 M	1,467
Business Services	$0 M	$927 M	$927 M	$525 M	$17 M	12,522
Automobile Rental and Leasing	$0 M	$29 M	$29 M	$8 M	$2 M	221
Auto Repair Services	$0 M	$102 M	$102 M	$37 M	$4 M	1,074
All Other Services	$0 M	$1,473 M	$1,473 M	$784 M	$16 M	15,845
Amusement and Recreation Services, N.E.C.	$0 M	$45 M	$45 M	$16 M	$2 M	632
Other State and Local Govt Enterprises	$0 M	$92 M	$92 M	$21 M	$0 M	377
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	27
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,436
Total Outlay	$17,982 M	$11,906 M	$29,888 M	$12,098 M	$1,296 M	189,938

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-2 SCENARIO #8
SCAG REGION 2020 NON-RESIDENT AIR PASSENGER IMPACTS

Sector	Millions Of 1998 $s Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$27 M	$27 M	$7 M	$0 M	129
Agriculture	$0 M	$14 M	$14 M	$5 M	$0 M	135
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$28 M	$28 M	$17 M	$1 M	1,108
Mining	$0 M	$8 M	$8 M	$2 M	$1 M	40
Construction	$0 M	$359 M	$359 M	$148 M	$3 M	3,185
Food Processing	$0 M	$436 M	$436 M	$69 M	$10 M	930
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$18 M	$18 M	$4 M	$0 M	100
Apparel	$0 M	$33 M	$33 M	$9 M	$0 M	203
Wood Products	$0 M	$6 M	$6 M	$2 M	$0 M	52
Furniture	$0 M	$16 M	$16 M	$5 M	$0 M	95
Pulp and Paper	$0 M	$115 M	$115 M	$27 M	$1 M	331
Printing & Publishing	$0 M	$175 M	$175 M	$67 M	$2 M	1,227
Chemicals	$0 M	$107 M	$107 M	$21 M	$1 M	213
Petroleum & Coal Products	$0 M	$229 M	$229 M	$16 M	$8 M	70
Rubber Products	$0 M	$3 M	$3 M	$1 M	$0 M	8
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	50
Stone Clay & Glass Products	$0 M	$5 M	$5 M	$1 M	$0 M	17
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	3
Fabricated Metals	$0 M	$13 M	$13 M	$4 M	$0 M	46
Industrial Machinery	$0 M	$14 M	$14 M	$4 M	$0 M	49
Electrical Machinery	$0 M	$155 M	$155 M	$43 M	$1 M	453
Transportation Equipment	$0 M	$7 M	$7 M	$2 M	$0 M	19
Scientific Instruments	$0 M	$41 M	$41 M	$14 M	$0 M	107
Miscellaneous Manufacturing	$0 M	$44 M	$44 M	$13 M	$1 M	257
Railroads and Related Services	$0 M	$22 M	$22 M	$8 M	$1 M	77
Local, Interurban Passenger Transit	$379 M	$17 M	$396 M	$236 M	$5 M	6,963
Motor Freight Transport and Warehousing	$0 M	$175 M	$175 M	$57 M	$3 M	829
Water Transportation	$0 M	$20 M	$20 M	$6 M	$1 M	49
Air Transportation	$0 M	$55 M	$55 M	$23 M	$2 M	323
Other Transportation	$379 M	$212 M	$591 M	$385 M	$6 M	5,526
Communications & Public Utilities	$0 M	$861 M	$861 M	$198 M	$60 M	1,933
Wholesale Trade	$0 M	$680 M	$680 M	$276 M	$105 M	3,999
Other Retail Trade	$1,908 M	$5,467 M	$7,374 M	$1,262 M	$1,187 M	40,410
Eating & Drinking	$4,096 M	$267 M	$4,363 M	$1,674 M	$311 M	114,094
FIRE	$0 M	$2,146 M	$2,146 M	$319 M	$219 M	5,581
Hotels and Lodging Places	$6,106 M	$124 M	$6,230 M	$2,382 M	$405 M	83,195
Personal Services	$0 M	$121 M	$121 M	$57 M	$3 M	2,364
Business Services	$0 M	$1,007 M	$1,007 M	$571 M	$19 M	13,608
Automobile Rental and Leasing	$1,118 M	$47 M	$1,165 M	$331 M	$81 M	9,001
Auto Repair Services	$0 M	$131 M	$131 M	$47 M	$6 M	1,383
All Other Services	$856 M	$1,749 M	$2,605 M	$1,387 M	$29 M	28,017
Amusement and Recreation Services, N.E.C.	$1,084 M	$39 M	$1,124 M	$404 M	$53 M	15,957
Other State and Local Govt Enterprises	$0 M	$113 M	$113 M	$25 M	$0 M	462
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	28
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,159
Total Outlay	$15,927 M	$15,118 M	$31,045 M	$10,801 M	$2,525 M	344,787

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 AND LEVEL-2 SCENARIO #8
SCAG REGION 2020 AIR SERVICESN AND NON-RESIDENT AIR PASSENGER IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$0 M	$38 M	$38 M	$10 M	$0 M	179
Agriculture	$0 M	$20 M	$20 M	$7 M	$0 M	195
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	1
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$36 M	$36 M	$22 M	$1 M	1,427
Mining	$0 M	$37 M	$37 M	$9 M	$2 M	177
Construction	$0 M	$547 M	$547 M	$225 M	$4 M	4,850
Food Processing	$0 M	$606 M	$606 M	$95 M	$14 M	1,293
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$34 M	$34 M	$8 M	$0 M	189
Apparel	$0 M	$59 M	$59 M	$15 M	$0 M	362
Wood Products	$0 M	$10 M	$10 M	$3 M	$0 M	85
Furniture	$0 M	$34 M	$34 M	$10 M	$0 M	201
Pulp and Paper	$0 M	$175 M	$175 M	$41 M	$2 M	504
Printing & Publishing	$0 M	$332 M	$332 M	$127 M	$4 M	2,334
Chemicals	$0 M	$199 M	$199 M	$40 M	$2 M	393
Petroleum & Coal Products	$0 M	$1,659 M	$1,659 M	$118 M	$59 M	505
Rubber Products	$0 M	$4 M	$4 M	$1 M	$0 M	13
Leather Products	$0 M	$10 M	$10 M	$3 M	$0 M	100
Stone Clay & Glass Products	$0 M	$8 M	$8 M	$2 M	$0 M	27
Primary Metals	$0 M	$2 M	$2 M	$0 M	$0 M	5
Fabricated Metals	$0 M	$22 M	$22 M	$7 M	$0 M	81
Industrial Machinery	$0 M	$24 M	$24 M	$8 M	$0 M	82
Electrical Machinery	$0 M	$310 M	$310 M	$87 M	$3 M	907
Transportation Equipment	$0 M	$24 M	$24 M	$8 M	$0 M	66
Scientific Instruments	$0 M	$74 M	$74 M	$26 M	$1 M	193
Miscellaneous Manufacturing	$0 M	$81 M	$81 M	$24 M	$1 M	479
Railroads and Related Services	$0 M	$45 M	$45 M	$18 M	$1 M	161
Local, Interurban Passenger Transit	$379 M	$33 M	$412 M	$245 M	$5 M	7,323
Motor Freight Transport and Warehousing	$0 M	$300 M	$300 M	$97 M	$5 M	1,423
Water Transportation	$0 M	$64 M	$64 M	$18 M	$2 M	153
Air Transportation	$17,982 M	$419 M	$18,401 M	$7,697 M	$575 M	108,749
Other Transportation	$379 M	$1,373 M	$1,752 M	$1,142 M	$18 M	16,389
Communications & Public Utilities	$0 M	$1,492 M	$1,492 M	$343 M	$104 M	3,351
Wholesale Trade	$0 M	$1,269 M	$1,269 M	$515 M	$195 M	7,462
Other Retail Trade	$1,908 M	$7,147 M	$9,054 M	$1,550 M	$1,458 M	49,617
Eating & Drinking	$4,096 M	$626 M	$4,722 M	$1,812 M	$337 M	123,481
FIRE	$0 M	$3,706 M	$3,706 M	$551 M	$377 M	9,635
Hotels and Lodging Places	$6,106 M	$241 M	$6,347 M	$2,427 M	$412 M	84,748
Personal Services	$0 M	$197 M	$197 M	$92 M	$6 M	3,831
Business Services	$0 M	$1,934 M	$1,934 M	$1,097 M	$36 M	26,130
Automobile Rental and Leasing	$1,118 M	$76 M	$1,194 M	$339 M	$83 M	9,221
Auto Repair Services	$0 M	$233 M	$233 M	$84 M	$10 M	2,457
All Other Services	$856 M	$3,222 M	$4,078 M	$2,171 M	$45 M	43,862
Amusement and Recreation Services, N.E.C.	$1,084 M	$84 M	$1,168 M	$420 M	$55 M	16,590
Other State and Local Govt Enterprises	$0 M	$205 M	$205 M	$46 M	$0 M	838
Other Federal Government Enterprises	$0 M	$14 M	$14 M	$4 M	$0 M	55
Household Income*	$0 M	$0 M	$0 M	$1,335 M	$0 M	4,595
Total Outlay	$33,909 M	$27,024 M	$60,933 M	$22,899 M	$3,821 M	534,725

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-3 SCENARIO #8
SCAG REGION 2020 AIR CARGO IMPACTS

Sector	Millions Of 1998 $s					
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$17 M	$12 M	$29 M	$7 M	$0 M	138
Agriculture	$17 M	$10 M	$27 M	$9 M	$1 M	267
Forestry & Forest Products	$1 M	$0 M	$1 M	$0 M	$0 M	5
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	224
Agricultural Services	$0 M	$16 M	$16 M	$10 M	$0 M	650
Mining	$0 M	$20 M	$20 M	$5 M	$1 M	94
Construction	$0 M	$309 M	$309 M	$127 M	$2 M	2,738
Food Processing	$23 M	$165 M	$188 M	$30 M	$4 M	401
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$42 M	$235 M	$277 M	$66 M	$2 M	1,553
Apparel	$1,136 M	$80 M	$1,216 M	$314 M	$5 M	7,416
Wood Products	$3 M	$13 M	$16 M	$6 M	$0 M	144
Furniture	$136 M	$77 M	$213 M	$62 M	$1 M	1,265
Pulp and Paper	$23 M	$234 M	$257 M	$60 M	$3 M	743
Printing & Publishing	$150 M	$168 M	$318 M	$121 M	$4 M	2,233
Chemicals	$360 M	$333 M	$692 M	$138 M	$7 M	1,372
Petroleum & Coal Products	$8 M	$210 M	$219 M	$16 M	$8 M	66
Rubber Products	$178 M	$11 M	$189 M	$44 M	$1 M	571
Leather Products	$12 M	$8 M	$20 M	$6 M	$0 M	198
Stone Clay & Glass Products	$71 M	$11 M	$82 M	$24 M	$1 M	292
Primary Metals	$307 M	$44 M	$351 M	$71 M	$4 M	770
Fabricated Metals	$351 M	$138 M	$489 M	$146 M	$5 M	1,773
Industrial Machinery	$1,277 M	$124 M	$1,401 M	$435 M	$11 M	4,776
Electrical Machinery	$7,122 M	$2,298 M	$9,420 M	$2,643 M	$79 M	27,520
Transportation Equipment	$4,501 M	$40 M	$4,541 M	$1,557 M	$42 M	12,344
Scientific Instruments	$4,706 M	$315 M	$5,021 M	$1,769 M	$35 M	13,078
Miscellaneous Manufacturing	$561 M	$65 M	$626 M	$188 M	$11 M	3,684
Railroads and Related Services	$0 M	$46 M	$46 M	$18 M	$1 M	166
Local, Interurban Passenger Transit	$0 M	$21 M	$21 M	$13 M	$0 M	474
Motor Freight Transport and Warehousing	$0 M	$300 M	$300 M	$97 M	$5 M	1,425
Water Transportation	$0 M	$25 M	$25 M	$7 M	$1 M	60
Air Transportation	$0 M	$81 M	$81 M	$34 M	$3 M	476
Other Transportation	$0 M	$121 M	$121 M	$79 M	$1 M	1,132
Communications & Public Utilities	$0 M	$738 M	$738 M	$170 M	$52 M	1,658
Wholesale Trade	$0 M	$2,002 M	$2,002 M	$812 M	$308 M	11,775
Other Retail Trade	$0 M	$1,753 M	$1,753 M	$300 M	$282 M	9,607
Eating & Drinking	$0 M	$292 M	$292 M	$112 M	$21 M	7,636
FIRE	$0 M	$1,696 M	$1,696 M	$252 M	$173 M	4,410
Hotels and Lodging Places	$0 M	$174 M	$174 M	$67 M	$11 M	2,328
Personal Services	$0 M	$87 M	$87 M	$41 M	$2 M	1,686
Business Services	$0 M	$965 M	$965 M	$547 M	$18 M	13,032
Automobile Rental and Leasing	$0 M	$40 M	$40 M	$11 M	$3 M	309
Auto Repair Services	$0 M	$196 M	$196 M	$71 M	$8 M	2,073
All Other Services	$0 M	$1,820 M	$1,820 M	$969 M	$20 M	19,577
Amusement and Recreation Services, N.E.C.	$0 M	$45 M	$45 M	$16 M	$2 M	637
Other State and Local Govt Enterprises	$0 M	$119 M	$119 M	$26 M	$0 M	484
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	26
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,452
Total Outlay	$21,016 M	$15,465 M	$36,481 M	$12,174 M	$1,140 M	165,739

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1, LEVEL-2, AND LEVEL-3 SCENARIO #8
COMBINED SCAG REGION 2020 AIR TRANSPORTATION SERVICES, NON-RESIDENT AIR PASSENGER IMPACTS, AND AIR CARGO IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$17 M	$50 M	$66 M	$17 M	$1 M	317
Agriculture	$17 M	$29 M	$47 M	$16 M	$1 M	462
Forestry & Forest Products	$1 M	$1 M	$1 M	$0 M	$0 M	6
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	226
Agricultural Services	$0 M	$52 M	$52 M	$32 M	$2 M	2,078
Mining	$0 M	$57 M	$57 M	$13 M	$3 M	271
Construction	$0 M	$855 M	$855 M	$352 M	$7 M	7,587
Food Processing	$23 M	$771 M	$794 M	$125 M	$19 M	1,694
Tobacco	$0 M	$1 M	$1 M	$0 M	$0 M	1
Textiles	$42 M	$269 M	$310 M	$74 M	$2 M	1,743
Apparel	$1,136 M	$139 M	$1,275 M	$329 M	$5 M	7,778
Wood Products	$3 M	$23 M	$26 M	$9 M	$0 M	229
Furniture	$136 M	$111 M	$246 M	$72 M	$1 M	1,466
Pulp and Paper	$23 M	$409 M	$432 M	$100 M	$5 M	1,247
Printing & Publishing	$150 M	$500 M	$650 M	$248 M	$7 M	4,568
Chemicals	$360 M	$531 M	$891 M	$178 M	$9 M	1,765
Petroleum & Coal Products	$8 M	$1,870 M	$1,878 M	$133 M	$67 M	571
Rubber Products	$178 M	$15 M	$193 M	$45 M	$1 M	584
Leather Products	$12 M	$18 M	$30 M	$10 M	$0 M	298
Stone Clay & Glass Products	$71 M	$19 M	$89 M	$26 M	$1 M	319
Primary Metals	$307 M	$46 M	$353 M	$72 M	$4 M	775
Fabricated Metals	$351 M	$160 M	$511 M	$152 M	$5 M	1,853
Industrial Machinery	$1,277 M	$149 M	$1,425 M	$443 M	$11 M	4,859
Electrical Machinery	$7,122 M	$2,609 M	$9,731 M	$2,731 M	$82 M	28,427
Transportation Equipment	$4,501 M	$64 M	$4,565 M	$1,565 M	$43 M	12,410
Scientific Instruments	$4,706 M	$389 M	$5,095 M	$1,795 M	$35 M	13,272
Miscellaneous Manufacturing	$561 M	$147 M	$708 M	$213 M	$13 M	4,163
Railroads and Related Services	$0 M	$91 M	$91 M	$36 M	$2 M	327
Local, Interurban Passenger Transit	$379 M	$54 M	$433 M	$258 M	$5 M	7,797
Motor Freight Transport and Warehousing	$0 M	$600 M	$600 M	$194 M	$9 M	2,848
Water Transportation	$0 M	$89 M	$89 M	$25 M	$3 M	213
Air Transportation	$17,982 M	$500 M	$18,482 M	$7,731 M	$578 M	109,225
Other Transportation	$379 M	$1,494 M	$1,873 M	$1,221 M	$20 M	17,521
Communications & Public Utilities	$0 M	$2,230 M	$2,230 M	$513 M	$156 M	5,010
Wholesale Trade	$0 M	$3,271 M	$3,271 M	$1,327 M	$504 M	19,238
Other Retail Trade	$1,908 M	$8,900 M	$10,807 M	$1,850 M	$1,740 M	59,225
Eating & Drinking	$4,096 M	$918 M	$5,014 M	$1,924 M	$358 M	131,117
FIRE	$0 M	$5,402 M	$5,402 M	$804 M	$550 M	14,046
Hotels and Lodging Places	$6,106 M	$415 M	$6,521 M	$2,493 M	$424 M	87,076
Personal Services	$0 M	$283 M	$283 M	$133 M	$8 M	5,517
Business Services	$0 M	$2,899 M	$2,899 M	$1,643 M	$54 M	39,162
Automobile Rental and Leasing	$1,118 M	$116 M	$1,234 M	$350 M	$86 M	9,530
Auto Repair Services	$0 M	$429 M	$429 M	$155 M	$18 M	4,530
All Other Services	$856 M	$5,042 M	$5,899 M	$3,140 M	$65 M	63,439
Amusement and Recreation Services, N.E.C.	$1,084 M	$129 M	$1,213 M	$436 M	$57 M	17,226
Other State and Local Govt Enterprises	$0 M	$324 M	$324 M	$72 M	$0 M	1,322
Other Federal Government Enterprises	$0 M	$21 M	$21 M	$6 M	$0 M	81
Household Income*	$0 M	$0 M	$0 M	$2,002 M	$0 M	7,047
Total Outlay	$54,925 M	$42,489 M	$97,414 M	$35,073 M	$4,962 M	700,464

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 SCENARIO #9
SCAG REGION 2020 AIR TRANSPORTATION SERVICES IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$0 M	$10 M	$10 M	$3 M	$0 M	50
Agriculture	$0 M	$6 M	$6 M	$2 M	$0 M	60
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	0
Agricultural Services	$0 M	$8 M	$8 M	$5 M	$0 M	316
Mining	$0 M	$28 M	$28 M	$7 M	$2 M	135
Construction	$0 M	$186 M	$186 M	$76 M	$1 M	1,647
Food Processing	$0 M	$168 M	$168 M	$26 M	$4 M	359
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$16 M	$16 M	$4 M	$0 M	88
Apparel	$0 M	$26 M	$26 M	$7 M	$0 M	157
Wood Products	$0 M	$4 M	$4 M	$1 M	$0 M	33
Furniture	$0 M	$18 M	$18 M	$5 M	$0 M	105
Pulp and Paper	$0 M	$59 M	$59 M	$14 M	$1 M	172
Printing & Publishing	$0 M	$156 M	$156 M	$59 M	$2 M	1,096
Chemicals	$0 M	$90 M	$90 M	$18 M	$1 M	179
Petroleum & Coal Products	$0 M	$1,415 M	$1,415 M	$101 M	$50 M	430
Rubber Products	$0 M	$2 M	$2 M	$0 M	$0 M	5
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	50
Stone Clay & Glass Products	$0 M	$3 M	$3 M	$1 M	$0 M	10
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	2
Fabricated Metals	$0 M	$9 M	$9 M	$3 M	$0 M	34
Industrial Machinery	$0 M	$10 M	$10 M	$3 M	$0 M	33
Electrical Machinery	$0 M	$154 M	$154 M	$43 M	$1 M	449
Transportation Equipment	$0 M	$17 M	$17 M	$6 M	$0 M	47
Scientific Instruments	$0 M	$33 M	$33 M	$12 M	$0 M	86
Miscellaneous Manufacturing	$0 M	$37 M	$37 M	$11 M	$1 M	220
Railroads and Related Services	$0 M	$23 M	$23 M	$9 M	$1 M	83
Local, Interurban Passenger Transit	$0 M	$16 M	$16 M	$10 M	$0 M	357
Motor Freight Transport and Warehousing	$0 M	$124 M	$124 M	$40 M	$2 M	587
Water Transportation	$0 M	$43 M	$43 M	$12 M	$2 M	103
Air Transportation	$17,792 M	$361 M	$18,153 M	$7,593 M	$568 M	107,283
Other Transportation	$0 M	$1,149 M	$1,149 M	$749 M	$12 M	10,748
Communications & Public Utilities	$0 M	$624 M	$624 M	$144 M	$44 M	1,403
Wholesale Trade	$0 M	$583 M	$583 M	$236 M	$90 M	3,427
Other Retail Trade	$0 M	$1,662 M	$1,662 M	$285 M	$268 M	9,110
Eating & Drinking	$0 M	$355 M	$355 M	$136 M	$25 M	9,288
FIRE	$0 M	$1,543 M	$1,543 M	$230 M	$157 M	4,011
Hotels and Lodging Places	$0 M	$115 M	$115 M	$44 M	$7 M	1,537
Personal Services	$0 M	$75 M	$75 M	$35 M	$2 M	1,452
Business Services	$0 M	$917 M	$917 M	$520 M	$17 M	12,390
Automobile Rental and Leasing	$0 M	$28 M	$28 M	$8 M	$2 M	219
Auto Repair Services	$0 M	$101 M	$101 M	$36 M	$4 M	1,062
All Other Services	$0 M	$1,458 M	$1,458 M	$776 M	$16 M	15,678
Amusement and Recreation Services, N.E.C.	$0 M	$44 M	$44 M	$16 M	$2 M	626
Other State and Local Govt Enterprises	$0 M	$91 M	$91 M	$20 M	$0 M	373
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	27
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,410
Total Outlay	$17,792 M	$11,780 M	$29,573 M	$11,977 M	$1,283 M	187,935

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-2 SCENARIO #9
SCAG REGION 2020 NON-RESIDENT AIR PASSENGER IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$28 M	$28 M	$7 M	$0 M	132
Agriculture	$0 M	$14 M	$14 M	$5 M	$0 M	138
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	1
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$28 M	$28 M	$18 M	$1 M	1,132
Mining	$0 M	$9 M	$9 M	$2 M	$1 M	41
Construction	$0 M	$367 M	$367 M	$151 M	$3 M	3,256
Food Processing	$0 M	$446 M	$446 M	$70 M	$10 M	952
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$18 M	$18 M	$4 M	$0 M	102
Apparel	$0 M	$34 M	$34 M	$9 M	$0 M	208
Wood Products	$0 M	$6 M	$6 M	$2 M	$0 M	53
Furniture	$0 M	$16 M	$16 M	$5 M	$0 M	98
Pulp and Paper	$0 M	$117 M	$117 M	$27 M	$1 M	338
Printing & Publishing	$0 M	$178 M	$178 M	$68 M	$2 M	1,254
Chemicals	$0 M	$110 M	$110 M	$22 M	$1 M	217
Petroleum & Coal Products	$0 M	$234 M	$234 M	$17 M	$8 M	71
Rubber Products	$0 M	$3 M	$3 M	$1 M	$0 M	8
Leather Products	$0 M	$5 M	$5 M	$2 M	$0 M	51
Stone Clay & Glass Products	$0 M	$5 M	$5 M	$1 M	$0 M	17
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	3
Fabricated Metals	$0 M	$13 M	$13 M	$4 M	$0 M	47
Industrial Machinery	$0 M	$15 M	$15 M	$5 M	$0 M	50
Electrical Machinery	$0 M	$158 M	$158 M	$44 M	$1 M	463
Transportation Equipment	$0 M	$7 M	$7 M	$2 M	$0 M	19
Scientific Instruments	$0 M	$42 M	$42 M	$15 M	$0 M	109
Miscellaneous Manufacturing	$0 M	$45 M	$45 M	$13 M	$1 M	262
Railroads and Related Services	$0 M	$22 M	$22 M	$9 M	$1 M	79
Local, Interurban Passenger Transit	$388 M	$17 M	$405 M	$241 M	$5 M	7,121
Motor Freight Transport and Warehousing	$0 M	$178 M	$178 M	$58 M	$3 M	847
Water Transportation	$0 M	$21 M	$21 M	$6 M	$1 M	50
Air Transportation	$0 M	$56 M	$56 M	$23 M	$2 M	330
Other Transportation	$388 M	$216 M	$604 M	$394 M	$6 M	5,650
Communications & Public Utilities	$0 M	$880 M	$880 M	$202 M	$62 M	1,976
Wholesale Trade	$0 M	$695 M	$695 M	$282 M	$107 M	4,089
Other Retail Trade	$1,957 M	$5,603 M	$7,560 M	$1,294 M	$1,217 M	41,427
Eating & Drinking	$4,189 M	$273 M	$4,463 M	$1,713 M	$318 M	116,698
FIRE	$0 M	$2,194 M	$2,194 M	$326 M	$223 M	5,705
Hotels and Lodging Places	$6,236 M	$127 M	$6,363 M	$2,433 M	$413 M	84,964
Personal Services	$0 M	$124 M	$124 M	$58 M	$4 M	2,416
Business Services	$0 M	$1,030 M	$1,030 M	$584 M	$19 M	13,912
Automobile Rental and Leasing	$1,138 M	$48 M	$1,186 M	$336 M	$83 M	9,163
Auto Repair Services	$0 M	$134 M	$134 M	$49 M	$6 M	1,414
All Other Services	$877 M	$1,788 M	$2,664 M	$1,418 M	$30 M	28,654
Amusement and Recreation Services, N.E.C.	$1,110 M	$40 M	$1,151 M	$414 M	$54 M	16,338
Other State and Local Govt Enterprises	$0 M	$116 M	$116 M	$26 M	$0 M	472
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	28
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,208
Total Outlay	$16,283 M	$15,469 M	$31,752 M	$11,029 M	$2,584 M	352,566

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 AND LEVEL-2 SCENARIO #9
SCAG REGION 2020 AIR SERVICESN AND NON-RESIDENT AIR PASSENGER IMPACTS

Sector	Millions Of 1998 $s					
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$38 M	$38 M	$10 M	$0 M	182
Agriculture	$0 M	$20 M	$20 M	$7 M	$0 M	198
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	1
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$36 M	$36 M	$23 M	$1 M	1,448
Mining	$0 M	$37 M	$37 M	$9 M	$2 M	176
Construction	$0 M	$553 M	$553 M	$227 M	$4 M	4,902
Food Processing	$0 M	$614 M	$614 M	$97 M	$14 M	1,310
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$34 M	$34 M	$8 M	$0 M	191
Apparel	$0 M	$60 M	$60 M	$15 M	$0 M	365
Wood Products	$0 M	$10 M	$10 M	$3 M	$0 M	86
Furniture	$0 M	$34 M	$34 M	$10 M	$0 M	202
Pulp and Paper	$0 M	$177 M	$177 M	$41 M	$2 M	510
Printing & Publishing	$0 M	$334 M	$334 M	$127 M	$4 M	2,350
Chemicals	$0 M	$200 M	$200 M	$40 M	$2 M	396
Petroleum & Coal Products	$0 M	$1,649 M	$1,649 M	$117 M	$59 M	502
Rubber Products	$0 M	$4 M	$4 M	$1 M	$0 M	13
Leather Products	$0 M	$10 M	$10 M	$3 M	$0 M	100
Stone Clay & Glass Products	$0 M	$8 M	$8 M	$2 M	$0 M	28
Primary Metals	$0 M	$2 M	$2 M	$0 M	$0 M	5
Fabricated Metals	$0 M	$22 M	$22 M	$7 M	$0 M	81
Industrial Machinery	$0 M	$24 M	$24 M	$8 M	$0 M	83
Electrical Machinery	$0 M	$312 M	$312 M	$88 M	$3 M	912
Transportation Equipment	$0 M	$24 M	$24 M	$8 M	$0 M	66
Scientific Instruments	$0 M	$75 M	$75 M	$26 M	$1 M	195
Miscellaneous Manufacturing	$0 M	$82 M	$82 M	$25 M	$1 M	483
Railroads and Related Services	$0 M	$45 M	$45 M	$18 M	$1 M	162
Local, Interurban Passenger Transit	$388 M	$33 M	$421 M	$250 M	$5 M	7,478
Motor Freight Transport and Warehousing	$0 M	$302 M	$302 M	$98 M	$5 M	1,435
Water Transportation	$0 M	$64 M	$64 M	$18 M	$2 M	153
Air Transportation	$17,792 M	$417 M	$18,209 M	$7,617 M	$569 M	107,612
Other Transportation	$388 M	$1,365 M	$1,753 M	$1,143 M	$18 M	16,398
Communications & Public Utilities	$0 M	$1,504 M	$1,504 M	$346 M	$105 M	3,380
Wholesale Trade	$0 M	$1,278 M	$1,278 M	$518 M	$197 M	7,515
Other Retail Trade	$1,957 M	$7,265 M	$9,222 M	$1,578 M	$1,485 M	50,537
Eating & Drinking	$4,189 M	$628 M	$4,818 M	$1,849 M	$344 M	125,986
FIRE	$0 M	$3,737 M	$3,737 M	$556 M	$380 M	9,716
Hotels and Lodging Places	$6,236 M	$242 M	$6,478 M	$2,477 M	$421 M	86,501
Personal Services	$0 M	$199 M	$199 M	$93 M	$6 M	3,868
Business Services	$0 M	$1,947 M	$1,947 M	$1,104 M	$36 M	26,302
Automobile Rental and Leasing	$1,138 M	$76 M	$1,214 M	$345 M	$85 M	9,382
Auto Repair Services	$0 M	$235 M	$235 M	$85 M	$10 M	2,476
All Other Services	$877 M	$3,245 M	$4,122 M	$2,194 M	$46 M	44,332
Amusement and Recreation Services, N.E.C.	$1,110 M	$84 M	$1,195 M	$430 M	$56 M	16,964
Other State and Local Govt Enterprises	$0 M	$207 M	$207 M	$46 M	$0 M	845
Other Federal Government Enterprises	$0 M	$14 M	$14 M	$4 M	$0 M	55
Household Income*	$0 M	$0 M	$0 M	$1,335 M	$0 M	4,618
Total Outlay	$34,075 M	$27,250 M	$61,325 M	$23,006 M	$3,867 M	540,501

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-3 SCENARIO #9
SCAG REGION 2020 AIR CARGO IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$16 M	$12 M	$29 M	$7 M	$0 M	136
Agriculture	$17 M	$9 M	$27 M	$9 M	$1 M	264
Forestry & Forest Products	$1 M	$0 M	$1 M	$0 M	$0 M	5
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	221
Agricultural Services	$0 M	$16 M	$16 M	$10 M	$0 M	644
Mining	$0 M	$19 M	$19 M	$5 M	$1 M	93
Construction	$0 M	$305 M	$305 M	$126 M	$2 M	2,709
Food Processing	$22 M	$163 M	$186 M	$29 M	$4 M	397
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$41 M	$232 M	$274 M	$66 M	$2 M	1,537
Apparel	$1,124 M	$79 M	$1,203 M	$310 M	$5 M	7,337
Wood Products	$3 M	$13 M	$16 M	$6 M	$0 M	142
Furniture	$134 M	$76 M	$210 M	$61 M	$1 M	1,251
Pulp and Paper	$23 M	$232 M	$255 M	$59 M	$3 M	735
Printing & Publishing	$148 M	$166 M	$314 M	$120 M	$3 M	2,210
Chemicals	$356 M	$329 M	$685 M	$137 M	$7 M	1,358
Petroleum & Coal Products	$8 M	$208 M	$216 M	$15 M	$8 M	66
Rubber Products	$176 M	$11 M	$187 M	$43 M	$1 M	565
Leather Products	$12 M	$8 M	$20 M	$6 M	$0 M	196
Stone Clay & Glass Products	$70 M	$11 M	$81 M	$24 M	$1 M	289
Primary Metals	$304 M	$43 M	$347 M	$71 M	$4 M	762
Fabricated Metals	$347 M	$137 M	$484 M	$144 M	$5 M	1,754
Industrial Machinery	$1,263 M	$123 M	$1,386 M	$431 M	$11 M	4,726
Electrical Machinery	$7,047 M	$2,274 M	$9,321 M	$2,616 M	$78 M	27,230
Transportation Equipment	$4,454 M	$39 M	$4,493 M	$1,540 M	$42 M	12,214
Scientific Instruments	$4,656 M	$312 M	$4,968 M	$1,750 M	$34 M	12,940
Miscellaneous Manufacturing	$555 M	$65 M	$620 M	$186 M	$11 M	3,645
Railroads and Related Services	$0 M	$46 M	$46 M	$18 M	$1 M	164
Local, Interurban Passenger Transit	$0 M	$21 M	$21 M	$12 M	$0 M	469
Motor Freight Transport and Warehousing	$0 M	$297 M	$297 M	$96 M	$5 M	1,410
Water Transportation	$0 M	$25 M	$25 M	$7 M	$1 M	59
Air Transportation	$0 M	$80 M	$80 M	$33 M	$2 M	471
Other Transportation	$0 M	$120 M	$120 M	$78 M	$1 M	1,120
Communications & Public Utilities	$0 M	$730 M	$730 M	$168 M	$51 M	1,641
Wholesale Trade	$0 M	$1,981 M	$1,981 M	$804 M	$305 M	11,651
Other Retail Trade	$0 M	$1,735 M	$1,735 M	$297 M	$279 M	9,506
Eating & Drinking	$0 M	$289 M	$289 M	$111 M	$21 M	7,556
FIRE	$0 M	$1,678 M	$1,678 M	$250 M	$171 M	4,364
Hotels and Lodging Places	$0 M	$173 M	$173 M	$66 M	$11 M	2,303
Personal Services	$0 M	$86 M	$86 M	$40 M	$2 M	1,668
Business Services	$0 M	$955 M	$955 M	$541 M	$18 M	12,895
Automobile Rental and Leasing	$0 M	$40 M	$40 M	$11 M	$3 M	305
Auto Repair Services	$0 M	$194 M	$194 M	$70 M	$8 M	2,051
All Other Services	$0 M	$1,801 M	$1,801 M	$959 M	$20 M	19,370
Amusement and Recreation Services, N.E.C.	$0 M	$44 M	$44 M	$16 M	$2 M	630
Other State and Local Govt Enterprises	$0 M	$117 M	$117 M	$26 M	$0 M	479
Other Federal Government Enterprises	$0 M	$7 M	$7 M	$2 M	$0 M	26
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,426
Total Outlay	$20,794 M	$15,302 M	$36,096 M	$12,053 M	$1,128 M	163,991

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1, LEVEL-2, AND LEVEL-3 SCENARIO #9
COMBINED SCAG REGION 2020 AIR TRANSPORTATION SERVICES, NON-RESIDENT AIR PASSENGER IMPACTS, AND AIR CARGO IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$16 M	$50 M	$67 M	$17 M	$1 M	318
Agriculture	$17 M	$29 M	$47 M	$16 M	$1 M	462
Forestry & Forest Products	$1 M	$1 M	$1 M	$0 M	$0 M	6
Commercial Fishing	$16 M	$0 M	$16 M	$8 M	$0 M	223
Agricultural Services	$0 M	$52 M	$52 M	$33 M	$2 M	2,092
Mining	$0 M	$56 M	$56 M	$13 M	$3 M	269
Construction	$0 M	$858 M	$858 M	$353 M	$7 M	7,611
Food Processing	$22 M	$777 M	$800 M	$126 M	$19 M	1,707
Tobacco	$0 M	$1 M	$1 M	$0 M	$0 M	1
Textiles	$41 M	$266 M	$308 M	$74 M	$2 M	1,727
Apparel	$1,124 M	$139 M	$1,263 M	$326 M	$5 M	7,703
Wood Products	$3 M	$23 M	$26 M	$9 M	$0 M	228
Furniture	$134 M	$110 M	$244 M	$71 M	$1 M	1,454
Pulp and Paper	$23 M	$408 M	$431 M	$100 M	$5 M	1,245
Printing & Publishing	$148 M	$501 M	$649 M	$247 M	$7 M	4,560
Chemicals	$356 M	$529 M	$885 M	$177 M	$9 M	1,754
Petroleum & Coal Products	$8 M	$1,857 M	$1,866 M	$133 M	$66 M	568
Rubber Products	$176 M	$15 M	$191 M	$44 M	$1 M	578
Leather Products	$12 M	$18 M	$30 M	$10 M	$0 M	296
Stone Clay & Glass Products	$70 M	$19 M	$89 M	$26 M	$1 M	317
Primary Metals	$304 M	$45 M	$349 M	$71 M	$4 M	767
Fabricated Metals	$347 M	$159 M	$506 M	$151 M	$5 M	1,835
Industrial Machinery	$1,263 M	$148 M	$1,411 M	$438 M	$11 M	4,809
Electrical Machinery	$7,047 M	$2,586 M	$9,633 M	$2,703 M	$81 M	28,142
Transportation Equipment	$4,454 M	$63 M	$4,517 M	$1,549 M	$42 M	12,280
Scientific Instruments	$4,656 M	$387 M	$5,043 M	$1,776 M	$35 M	13,135
Miscellaneous Manufacturing	$555 M	$147 M	$702 M	$211 M	$13 M	4,127
Railroads and Related Services	$0 M	$91 M	$91 M	$35 M	$2 M	327
Local, Interurban Passenger Transit	$388 M	$54 M	$442 M	$263 M	$5 M	7,947
Motor Freight Transport and Warehousing	$0 M	$599 M	$599 M	$194 M	$9 M	2,845
Water Transportation	$0 M	$89 M	$89 M	$25 M	$3 M	212
Air Transportation	$17,792 M	$496 M	$18,289 M	$7,650 M	$572 M	108,084
Other Transportation	$388 M	$1,485 M	$1,873 M	$1,221 M	$20 M	17,518
Communications & Public Utilities	$0 M	$2,234 M	$2,234 M	$514 M	$157 M	5,020
Wholesale Trade	$0 M	$3,259 M	$3,259 M	$1,322 M	$502 M	19,166
Other Retail Trade	$1,957 M	$9,000 M	$10,957 M	$1,875 M	$1,764 M	60,043
Eating & Drinking	$4,189 M	$917 M	$5,107 M	$1,960 M	$364 M	133,541
FIRE	$0 M	$5,415 M	$5,415 M	$806 M	$551 M	14,080
Hotels and Lodging Places	$6,236 M	$415 M	$6,650 M	$2,543 M	$432 M	88,804
Personal Services	$0 M	$284 M	$284 M	$134 M	$8 M	5,536
Business Services	$0 M	$2,902 M	$2,902 M	$1,645 M	$54 M	39,197
Automobile Rental and Leasing	$1,138 M	$116 M	$1,254 M	$356 M	$88 M	9,687
Auto Repair Services	$0 M	$429 M	$429 M	$155 M	$18 M	4,527
All Other Services	$877 M	$5,046 M	$5,923 M	$3,153 M	$66 M	63,703
Amusement and Recreation Services, N.E.C.	$1,110 M	$129 M	$1,239 M	$445 M	$58 M	17,593
Other State and Local Govt Enterprises	$0 M	$324 M	$324 M	$72 M	$0 M	1,323
Other Federal Government Enterprises	$0 M	$21 M	$21 M	$6 M	$0 M	81
Household Income*	$0 M	$0 M	$0 M	$2,002 M	$0 M	7,044
Total Outlay	$54,869 M	$42,552 M	$97,421 M	$35,059 M	$4,995 M	704,492

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 SCENARIO #6
SCAG REGION 2020 AIR TRANSPORTATION SERVICES IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$9 M	$9 M	$2 M	$0 M	45
Agriculture	$0 M	$5 M	$5 M	$2 M	$0 M	54
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	0
Agricultural Services	$0 M	$7 M	$7 M	$4 M	$0 M	288
Mining	$0 M	$26 M	$26 M	$6 M	$2 M	123
Construction	$0 M	$169 M	$169 M	$69 M	$1 M	1,498
Food Processing	$0 M	$153 M	$153 M	$24 M	$4 M	326
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$14 M	$14 M	$3 M	$0 M	80
Apparel	$0 M	$23 M	$23 M	$6 M	$0 M	143
Wood Products	$0 M	$3 M	$3 M	$1 M	$0 M	30
Furniture	$0 M	$16 M	$16 M	$5 M	$0 M	95
Pulp and Paper	$0 M	$54 M	$54 M	$13 M	$1 M	156
Printing & Publishing	$0 M	$142 M	$142 M	$54 M	$2 M	997
Chemicals	$0 M	$82 M	$82 M	$16 M	$1 M	163
Petroleum & Coal Products	$0 M	$1,287 M	$1,287 M	$91 M	$46 M	392
Rubber Products	$0 M	$2 M	$2 M	$0 M	$0 M	5
Leather Products	$0 M	$5 M	$5 M	$1 M	$0 M	45
Stone Clay & Glass Products	$0 M	$3 M	$3 M	$1 M	$0 M	9
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	2
Fabricated Metals	$0 M	$9 M	$9 M	$3 M	$0 M	31
Industrial Machinery	$0 M	$9 M	$9 M	$3 M	$0 M	30
Electrical Machinery	$0 M	$140 M	$140 M	$39 M	$1 M	409
Transportation Equipment	$0 M	$16 M	$16 M	$5 M	$0 M	42
Scientific Instruments	$0 M	$30 M	$30 M	$11 M	$0 M	78
Miscellaneous Manufacturing	$0 M	$34 M	$34 M	$10 M	$1 M	200
Railroads and Related Services	$0 M	$21 M	$21 M	$8 M	$1 M	75
Local, Interurban Passenger Transit	$0 M	$15 M	$15 M	$9 M	$0 M	324
Motor Freight Transport and Warehousing	$0 M	$113 M	$113 M	$36 M	$2 M	534
Water Transportation	$0 M	$39 M	$39 M	$11 M	$1 M	94
Air Transportation	$16,187 M	$328 M	$16,515 M	$6,908 M	$516 M	97,603
Other Transportation	$0 M	$1,046 M	$1,046 M	$682 M	$11 M	9,778
Communications & Public Utilities	$0 M	$568 M	$568 M	$131 M	$40 M	1,277
Wholesale Trade	$0 M	$530 M	$530 M	$215 M	$82 M	3,117
Other Retail Trade	$0 M	$1,512 M	$1,512 M	$259 M	$244 M	8,288
Eating & Drinking	$0 M	$323 M	$323 M	$124 M	$23 M	8,450
FIRE	$0 M	$1,404 M	$1,404 M	$209 M	$143 M	3,649
Hotels and Lodging Places	$0 M	$105 M	$105 M	$40 M	$7 M	1,398
Personal Services	$0 M	$68 M	$68 M	$32 M	$2 M	1,321
Business Services	$0 M	$834 M	$834 M	$473 M	$16 M	11,272
Automobile Rental and Leasing	$0 M	$26 M	$26 M	$7 M	$2 M	199
Auto Repair Services	$0 M	$92 M	$92 M	$33 M	$4 M	967
All Other Services	$0 M	$1,326 M	$1,326 M	$706 M	$15 M	14,263
Amusement and Recreation Services, N.E.C.	$0 M	$40 M	$40 M	$14 M	$2 M	569
Other State and Local Govt Enterprises	$0 M	$83 M	$83 M	$19 M	$0 M	339
Other Federal Government Enterprises	$0 M	$6 M	$6 M	$2 M	$0 M	24
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,193
Total Outlay	$16,187 M	$10,718 M	$26,904 M	$10,957 M	$1,167 M	170,978

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-2 SCENARIO #6
SCAG REGION 2020 NON-RESIDENT AIR PASSENGER IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$0 M	$24 M	$24 M	$6 M	$0 M	113
Agriculture	$0 M	$12 M	$12 M	$4 M	$0 M	119
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	0
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	1
Agricultural Services	$0 M	$24 M	$24 M	$15 M	$1 M	974
Mining	$0 M	$7 M	$7 M	$2 M	$0 M	36
Construction	$0 M	$316 M	$316 M	$130 M	$2 M	2,800
Food Processing	$0 M	$383 M	$383 M	$60 M	$9 M	818
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$16 M	$16 M	$4 M	$0 M	88
Apparel	$0 M	$29 M	$29 M	$8 M	$0 M	179
Wood Products	$0 M	$5 M	$5 M	$2 M	$0 M	46
Furniture	$0 M	$14 M	$14 M	$4 M	$0 M	84
Pulp and Paper	$0 M	$101 M	$101 M	$23 M	$1 M	291
Printing & Publishing	$0 M	$153 M	$153 M	$59 M	$2 M	1,079
Chemicals	$0 M	$94 M	$94 M	$19 M	$1 M	187
Petroleum & Coal Products	$0 M	$202 M	$202 M	$14 M	$7 M	61
Rubber Products	$0 M	$2 M	$2 M	$1 M	$0 M	7
Leather Products	$0 M	$4 M	$4 M	$1 M	$0 M	44
Stone Clay & Glass Products	$0 M	$4 M	$4 M	$1 M	$0 M	15
Primary Metals	$0 M	$1 M	$1 M	$0 M	$0 M	2
Fabricated Metals	$0 M	$11 M	$11 M	$3 M	$0 M	41
Industrial Machinery	$0 M	$13 M	$13 M	$4 M	$0 M	43
Electrical Machinery	$0 M	$136 M	$136 M	$38 M	$1 M	398
Transportation Equipment	$0 M	$6 M	$6 M	$2 M	$0 M	16
Scientific Instruments	$0 M	$36 M	$36 M	$13 M	$0 M	94
Miscellaneous Manufacturing	$0 M	$38 M	$38 M	$12 M	$1 M	226
Railroads and Related Services	$0 M	$19 M	$19 M	$7 M	$0 M	68
Local, Interurban Passenger Transit	$333 M	$15 M	$348 M	$207 M	$4 M	6,123
Motor Freight Transport and Warehousing	$0 M	$153 M	$153 M	$50 M	$2 M	729
Water Transportation	$0 M	$18 M	$18 M	$5 M	$1 M	43
Air Transportation	$0 M	$48 M	$48 M	$20 M	$2 M	284
Other Transportation	$333 M	$186 M	$520 M	$339 M	$5 M	4,859
Communications & Public Utilities	$0 M	$756 M	$756 M	$174 M	$53 M	1,700
Wholesale Trade	$0 M	$598 M	$598 M	$243 M	$92 M	3,516
Other Retail Trade	$1,680 M	$4,813 M	$6,493 M	$1,111 M	$1,046 M	35,581
Eating & Drinking	$3,602 M	$235 M	$3,837 M	$1,473 M	$274 M	100,334
FIRE	$0 M	$1,887 M	$1,887 M	$281 M	$192 M	4,906
Hotels and Lodging Places	$5,365 M	$109 M	$5,475 M	$2,093 M	$356 M	73,101
Personal Services	$0 M	$107 M	$107 M	$50 M	$3 M	2,078
Business Services	$0 M	$886 M	$886 M	$502 M	$16 M	11,964
Automobile Rental and Leasing	$981 M	$41 M	$1,022 M	$290 M	$71 M	7,895
Auto Repair Services	$0 M	$115 M	$115 M	$42 M	$5 M	1,216
All Other Services	$753 M	$1,537 M	$2,291 M	$1,219 M	$25 M	24,637
Amusement and Recreation Services, N.E.C.	$954 M	$35 M	$989 M	$356 M	$46 M	14,041
Other State and Local Govt Enterprises	$0 M	$100 M	$100 M	$22 M	$0 M	406
Other Federal Government Enterprises	$0 M	$6 M	$6 M	$2 M	$0 M	24
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	1,898
Total Outlay	$14,003 M	$13,298 M	$27,300 M	$9,577 M	$2,221 M	303,164

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1 AND LEVEL-2 SCENARIO #6
SCAG REGION 2020 AIR SERVICESN AND NON-RESIDENT AIR PASSENGER IMPACTS

	Millions Of 1998 $s					
Sector	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	Employment Impacts
Livestock & Livestock Products	$0 M	$33 M	$33 M	$8 M	$0 M	159
Agriculture	$0 M	$18 M	$18 M	$6 M	$0 M	173
Forestry & Forest Products	$0 M	$0 M	$0 M	$0 M	$0 M	1
Commercial Fishing	$0 M	$0 M	$0 M	$0 M	$0 M	2
Agricultural Services	$0 M	$32 M	$32 M	$20 M	$1 M	1,261
Mining	$0 M	$33 M	$33 M	$8 M	$2 M	158
Construction	$0 M	$484 M	$484 M	$199 M	$4 M	4,298
Food Processing	$0 M	$536 M	$536 M	$84 M	$13 M	1,144
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$0 M	$30 M	$30 M	$7 M	$0 M	168
Apparel	$0 M	$53 M	$53 M	$14 M	$0 M	322
Wood Products	$0 M	$9 M	$9 M	$3 M	$0 M	75
Furniture	$0 M	$30 M	$30 M	$9 M	$0 M	179
Pulp and Paper	$0 M	$155 M	$155 M	$36 M	$2 M	447
Printing & Publishing	$0 M	$295 M	$295 M	$113 M	$3 M	2,076
Chemicals	$0 M	$176 M	$176 M	$35 M	$2 M	350
Petroleum & Coal Products	$0 M	$1,489 M	$1,489 M	$106 M	$53 M	453
Rubber Products	$0 M	$4 M	$4 M	$1 M	$0 M	11
Leather Products	$0 M	$9 M	$9 M	$3 M	$0 M	89
Stone Clay & Glass Products	$0 M	$7 M	$7 M	$2 M	$0 M	24
Primary Metals	$0 M	$2 M	$2 M	$0 M	$0 M	4
Fabricated Metals	$0 M	$20 M	$20 M	$6 M	$0 M	72
Industrial Machinery	$0 M	$21 M	$21 M	$7 M	$0 M	73
Electrical Machinery	$0 M	$276 M	$276 M	$77 M	$2 M	807
Transportation Equipment	$0 M	$22 M	$22 M	$7 M	$0 M	59
Scientific Instruments	$0 M	$66 M	$66 M	$23 M	$0 M	172
Miscellaneous Manufacturing	$0 M	$72 M	$72 M	$22 M	$1 M	426
Railroads and Related Services	$0 M	$40 M	$40 M	$16 M	$1 M	144
Local, Interurban Passenger Transit	$333 M	$29 M	$363 M	$216 M	$4 M	6,447
Motor Freight Transport and Warehousing	$0 M	$266 M	$266 M	$86 M	$4 M	1,263
Water Transportation	$0 M	$57 M	$57 M	$16 M	$2 M	137
Air Transportation	$16,187 M	$376 M	$16,563 M	$6,928 M	$518 M	97,886
Other Transportation	$333 M	$1,232 M	$1,565 M	$1,020 M	$16 M	14,637
Communications & Public Utilities	$0 M	$1,325 M	$1,325 M	$305 M	$93 M	2,976
Wholesale Trade	$0 M	$1,128 M	$1,128 M	$458 M	$174 M	6,633
Other Retail Trade	$1,680 M	$6,325 M	$8,005 M	$1,370 M	$1,289 M	43,869
Eating & Drinking	$3,602 M	$558 M	$4,160 M	$1,597 M	$297 M	108,784
FIRE	$0 M	$3,290 M	$3,290 M	$490 M	$335 M	8,556
Hotels and Lodging Places	$5,365 M	$214 M	$5,579 M	$2,133 M	$362 M	74,499
Personal Services	$0 M	$174 M	$174 M	$82 M	$5 M	3,399
Business Services	$0 M	$1,720 M	$1,720 M	$975 M	$32 M	23,236
Automobile Rental and Leasing	$981 M	$67 M	$1,048 M	$297 M	$73 M	8,094
Auto Repair Services	$0 M	$207 M	$207 M	$75 M	$9 M	2,183
All Other Services	$753 M	$2,864 M	$3,617 M	$1,925 M	$40 M	38,900
Amusement and Recreation Services, N.E.C.	$954 M	$75 M	$1,029 M	$370 M	$48 M	14,610
Other State and Local Govt Enterprises	$0 M	$183 M	$183 M	$41 M	$0 M	745
Other Federal Government Enterprises	$0 M	$13 M	$13 M	$4 M	$0 M	49
Household Income*	$0 M	$0 M	$0 M	$1,335 M	$0 M	4,091
Total Outlay	$30,189 M	$24,015 M	$54,205 M	$20,534 M	$3,388 M	474,141

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-3 SCENARIO #6
SCAG REGION 2020 AIR CARGO IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$15 M	$11 M	$26 M	$7 M	$0 M	124
Agriculture	$16 M	$9 M	$24 M	$8 M	$1 M	240
Forestry & Forest Products	$0 M	$0 M	$1 M	$0 M	$0 M	4
Commercial Fishing	$15 M	$0 M	$15 M	$7 M	$0 M	201
Agricultural Services	$0 M	$15 M	$15 M	$9 M	$0 M	585
Mining	$0 M	$18 M	$18 M	$4 M	$1 M	85
Construction	$0 M	$278 M	$278 M	$114 M	$2 M	2,464
Food Processing	$20 M	$149 M	$169 M	$27 M	$4 M	361
Tobacco	$0 M	$0 M	$0 M	$0 M	$0 M	0
Textiles	$38 M	$211 M	$249 M	$60 M	$2 M	1,398
Apparel	$1,022 M	$72 M	$1,094 M	$282 M	$4 M	6,675
Wood Products	$3 M	$12 M	$15 M	$5 M	$0 M	129
Furniture	$122 M	$69 M	$191 M	$56 M	$1 M	1,139
Pulp and Paper	$21 M	$211 M	$232 M	$54 M	$3 M	669
Printing & Publishing	$135 M	$151 M	$286 M	$109 M	$3 M	2,010
Chemicals	$324 M	$299 M	$623 M	$125 M	$6 M	1,235
Petroleum & Coal Products	$8 M	$189 M	$197 M	$14 M	$7 M	60
Rubber Products	$160 M	$10 M	$170 M	$40 M	$1 M	514
Leather Products	$11 M	$7 M	$18 M	$6 M	$0 M	178
Stone Clay & Glass Products	$64 M	$10 M	$74 M	$22 M	$1 M	263
Primary Metals	$277 M	$39 M	$316 M	$64 M	$4 M	693
Fabricated Metals	$316 M	$124 M	$440 M	$131 M	$4 M	1,596
Industrial Machinery	$1,149 M	$112 M	$1,261 M	$392 M	$10 M	4,300
Electrical Machinery	$6,411 M	$2,069 M	$8,480 M	$2,380 M	$71 M	24,773
Transportation Equipment	$4,052 M	$36 M	$4,088 M	$1,401 M	$38 M	11,112
Scientific Instruments	$4,236 M	$284 M	$4,520 M	$1,592 M	$31 M	11,773
Miscellaneous Manufacturing	$505 M	$59 M	$564 M	$169 M	$10 M	3,316
Railroads and Related Services	$0 M	$42 M	$42 M	$16 M	$1 M	150
Local, Interurban Passenger Transit	$0 M	$19 M	$19 M	$11 M	$0 M	426
Motor Freight Transport and Warehousing	$0 M	$270 M	$270 M	$88 M	$4 M	1,283
Water Transportation	$0 M	$23 M	$23 M	$6 M	$1 M	54
Air Transportation	$0 M	$73 M	$73 M	$30 M	$2 M	429
Other Transportation	$0 M	$109 M	$109 M	$71 M	$1 M	1,019
Communications & Public Utilities	$0 M	$664 M	$664 M	$153 M	$47 M	1,493
Wholesale Trade	$0 M	$1,802 M	$1,802 M	$731 M	$278 M	10,600
Other Retail Trade	$0 M	$1,578 M	$1,578 M	$270 M	$254 M	8,648
Eating & Drinking	$0 M	$263 M	$263 M	$101 M	$19 M	6,874
FIRE	$0 M	$1,527 M	$1,527 M	$227 M	$155 M	3,970
Hotels and Lodging Places	$0 M	$157 M	$157 M	$60 M	$10 M	2,096
Personal Services	$0 M	$78 M	$78 M	$37 M	$2 M	1,518
Business Services	$0 M	$868 M	$868 M	$492 M	$16 M	11,731
Automobile Rental and Leasing	$0 M	$36 M	$36 M	$10 M	$3 M	278
Auto Repair Services	$0 M	$177 M	$177 M	$64 M	$7 M	1,866
All Other Services	$0 M	$1,639 M	$1,639 M	$872 M	$18 M	17,623
Amusement and Recreation Services, N.E.C.	$0 M	$40 M	$40 M	$15 M	$2 M	573
Other State and Local Govt Enterprises	$0 M	$107 M	$107 M	$24 M	$0 M	436
Other Federal Government Enterprises	$0 M	$6 M	$6 M	$2 M	$0 M	24
Household Income*	$0 M	$0 M	$0 M	$667 M	$0 M	2,207
Total Outlay	$18,918 M	$13,921 M	$32,839 M	$11,025 M	$1,026 M	149,194

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

LEVEL-1, LEVEL-2, AND LEVEL-3 SCENARIO #6
COMBINED SCAG REGION 2020 AIR TRANSPORTATION SERVICES, NON-RESIDENT AIR PASSENGER IMPACTS, AND AIR CARGO IMPACTS

Sector	Millions Of 1998 $s					Employment Impacts
	Direct Impact	Indirect and Induced Impacts	Total Impacts	Income Impacts	Tax Revenue Impacts	
Livestock & Livestock Products	$15 M	$44 M	$59 M	$15 M	$0 M	282
Agriculture	$16 M	$26 M	$42 M	$14 M	$1 M	414
Forestry & Forest Products	$0 M	$0 M	$1 M	$0 M	$0 M	5
Commercial Fishing	$15 M	$0 M	$15 M	$8 M	$0 M	203
Agricultural Services	$0 M	$46 M	$46 M	$29 M	$1 M	1,847
Mining	$0 M	$51 M	$51 M	$12 M	$3 M	243
Construction	$0 M	$762 M	$762 M	$313 M	$6 M	6,762
Food Processing	$20 M	$685 M	$705 M	$111 M	$16 M	1,505
Tobacco	$0 M	$1 M	$1 M	$0 M	$0 M	1
Textiles	$38 M	$241 M	$279 M	$67 M	$2 M	1,567
Apparel	$1,022 M	$125 M	$1,147 M	$296 M	$4 M	6,997
Wood Products	$3 M	$21 M	$23 M	$8 M	$0 M	205
Furniture	$122 M	$99 M	$221 M	$65 M	$1 M	1,318
Pulp and Paper	$21 M	$366 M	$387 M	$90 M	$4 M	1,116
Printing & Publishing	$135 M	$447 M	$581 M	$222 M	$6 M	4,086
Chemicals	$324 M	$476 M	$800 M	$160 M	$8 M	1,585
Petroleum & Coal Products	$8 M	$1,678 M	$1,686 M	$120 M	$60 M	513
Rubber Products	$160 M	$13 M	$174 M	$40 M	$1 M	526
Leather Products	$11 M	$16 M	$27 M	$9 M	$0 M	267
Stone Clay & Glass Products	$64 M	$17 M	$80 M	$24 M	$1 M	287
Primary Metals	$277 M	$41 M	$318 M	$65 M	$4 M	698
Fabricated Metals	$316 M	$144 M	$460 M	$137 M	$5 M	1,667
Industrial Machinery	$1,149 M	$134 M	$1,283 M	$398 M	$10 M	4,373
Electrical Machinery	$6,411 M	$2,345 M	$8,756 M	$2,457 M	$74 M	25,580
Transportation Equipment	$4,052 M	$57 M	$4,109 M	$1,409 M	$38 M	11,171
Scientific Instruments	$4,236 M	$350 M	$4,586 M	$1,615 M	$32 M	11,944
Miscellaneous Manufacturing	$505 M	$131 M	$636 M	$191 M	$12 M	3,742
Railroads and Related Services	$0 M	$82 M	$82 M	$32 M	$2 M	293
Local, Interurban Passenger Transit	$333 M	$48 M	$382 M	$227 M	$5 M	6,874
Motor Freight Transport and Warehousing	$0 M	$536 M	$536 M	$174 M	$8 M	2,546
Water Transportation	$0 M	$80 M	$80 M	$22 M	$3 M	191
Air Transportation	$16,187 M	$449 M	$16,636 M	$6,959 M	$520 M	98,315
Other Transportation	$333 M	$1,341 M	$1,674 M	$1,091 M	$18 M	15,656
Communications & Public Utilities	$0 M	$1,989 M	$1,989 M	$458 M	$139 M	4,469
Wholesale Trade	$0 M	$2,930 M	$2,930 M	$1,189 M	$451 M	17,233
Other Retail Trade	$1,680 M	$7,903 M	$9,583 M	$1,640 M	$1,543 M	52,517
Eating & Drinking	$3,602 M	$821 M	$4,423 M	$1,697 M	$316 M	115,658
FIRE	$0 M	$4,817 M	$4,817 M	$717 M	$491 M	12,526
Hotels and Lodging Places	$5,365 M	$371 M	$5,736 M	$2,193 M	$373 M	76,595
Personal Services	$0 M	$252 M	$252 M	$119 M	$7 M	4,916
Business Services	$0 M	$2,589 M	$2,589 M	$1,467 M	$48 M	34,967
Automobile Rental and Leasing	$981 M	$103 M	$1,084 M	$307 M	$76 M	8,372
Auto Repair Services	$0 M	$384 M	$384 M	$139 M	$16 M	4,048
All Other Services	$753 M	$4,502 M	$5,256 M	$2,798 M	$58 M	56,523
Amusement and Recreation Services, N.E.C.	$954 M	$115 M	$1,069 M	$384 M	$50 M	15,183
Other State and Local Govt Enterprises	$0 M	$289 M	$289 M	$65 M	$0 M	1,181
Other Federal Government Enterprises	$0 M	$19 M	$19 M	$6 M	$0 M	73
Household Income*	$0 M	$0 M	$0 M	$2,002 M	$0 M	6,299
Total Outlay	$49,107 M	$37,937 M	$87,044 M	$31,559 M	$4,415 M	623,336

* Note: Sales of household labor are not included in regional output totals, but are included in the household income totals.

ASSESSMENT OF FACILITY CAPACITY ANALYSIS
(BURBANK, JOHN WAYNE AND LOS ANGELES INTERNATIONAL)

FINAL

Existing Physical Capacity of Burbank and John Wayne Airports

2/14/00

I. Introduction

The purpose of this paper is to present an overview of a recent evaluation of the existing physical capacity of Burbank and John Wayne airports, performed by the consulting form ATS for the SCAG Aviation Program's 2000 Regional Aviation System Study. This work was performed in response to the adoption by the SCAG Aviation Task Force, at its November 1999 meeting, of four new aviation system scenarios that constrained a number of airports to their existing physical capacity. Rather than assuming an unenforceable policy constraint, or an undocumented or obsolete physical capacity figure, new capacity levels were estimated using the most current information available. Airports that were the focus of this analysis included LAX, Burbank, John Wayne and Ontario airports. This paper summarizes results for Burbank and John Wayne airports because of their similarities in current passengers levels (4.7 million annual passengers or MAP at Burbank and 7.4 MAP at John Wayne) and existing terminal facilities (14 narrowbody jet gates at both facilities).

It should be noted at the outset that time and budgetary constraints did not permit a comprehensive facilities capacity analysis for the airports that were examined. Existing data and analyses provided by individual airports were relied upon to a large degree, providing that they were deemed relevant and contemporary. In the case of John Wayne Airport, a very recent facility capacity analysis of John Wayne that was conducted by P&D Aviation provided the basis for the capacity estimate, after validation of the methodology was made.

II. Burbank Airport

Gate Capacity

For a smaller non-hub airport such as Burbank, primarily providing direct point-to-point service, it was determined that about 670,000 passengers per narrowbody (B-757) gate per year is about the absolute limit that can be achieved. Going beyond that limit would result in unacceptable (15-20 minutes) delays in meeting aircraft schedules that would lead to a deterioration of overall airport service capacity. It would also exceed the ability of most airlines to process and load air passengers. The average gate utilization rate at U.S. airports is about 350,000 passengers per gate. It should be noted that a utilization rate of about 670,000 passengers per gate was achieved at John Wayne Airport's old 28,600-sq. ft. terminal just prior to the opening of its new terminal complex. Assuming the existing 14 gates, configured for 757 (narrowbody) aircraft, and a maximum gate utilization rate of 670,000 passengers per gate, results in an estimated maximum gate capacity at Burbank Airport of about 9.4 MAP.

Terminal Capacity

The RADAM methodology employed by ATS estimates that a level of service "F" (worst service level) is reached when ratios of terminal square footage per passenger drops to the following thresholds:

Commuter:	0.030
Short-haul:	0.034
Medium-haul:	0.037
Long-haul:	0.040

Currently serving about 5 MAP, the airport's existing 165,000-sq. ft. terminal operates at a ratio of 0.033 sq. ft. per passenger. This is just at the threshold of level of service "F" since the bulk of service that the airport currently provides is short-haul (unconstrained RADAM runs forecast 4% commuter, 55.3% short-haul, 31% medium-haul, and 9.7% long-haul in 2020). The planned 330,000-sq. ft. terminal, if it served 9.4 MAP (gate capacity) would operate at a level of 0.035-sq. ft. per passenger, or just slightly better than the existing ratio. Assuming that the airport would serve a greater percentage of medium-haul and long-haul passengers in the future, the new terminal would also perform at level of service "F". The new terminal would have to be expanded to about 490,000-sq. ft. (49% more than planned) to achieve a level of service "A" (best service level).

Assuming that a new terminal is not constructed, serving 9.4 MAP would result in a terminal sq. ft. per passenger ratio of 0.018. This would be at the extreme end of the range of level of service "F" and would result in highly adverse conditions for passengers. These conditions would include:

- No seating available for the majority of passengers, with severe congestion in waiting areas.
- Severe queuing at check-in counters and security check areas, with queuing spilling out of the terminal building during peak hours, resulting in delays on the order of 15-20 minutes.
- Well-wishes and non-passengers would not accompany passengers, or be allowed in terminals, as is the case at some highly congested airports.
- Severe terminal congestion would exert considerable pressure to reduce or eliminate amenities, except for those absolutely necessary.
- Passenger time before departure characteristics would change and require even commuter passengers to be at the airport one hour before departure.
- It is likely that a spreading of peak-hour service would occur in an effort to reduce delays in processing passengers.

A sq. ft. per passenger ratio of 0.018, however inconvenient, is attainable if there are no nearby airport options available. Before John Wayne Airport's new terminal opened, the airport's old terminal facility achieved a ratio of about 0.0072 sq. ft. per passenger (28,600-sq. ft. terminal serving about 4 MAP) or less than half of the 0.018 ratio forecast for Burbank Airport without a new terminal. Unless LAX implements master plan expansion improvements sufficient to accommodate forecast short-haul and medium-haul demand in the local service area shared by LAX and Burbank, Burbank Airport's terminal facilities are capable of reaching a sq. ft. per passenger ratio of 0.018.

Curbside Capacity

At 9.4 MAP, it is estimated that about 2,900 linear feet of curbside would be needed to adequately accommodate the estimated 1,620 peak-hour deplaning passenger vehicle trips, assuming a 10 minute curbside dwell time for the percentage of those vehicles using curbspace. This is 2.3 times the 1,250 linear feet of curbspace currently available at the Burbank Airport terminal. This inadequate curbspace would result in:

- Increased vehicular conflicts, with vehicles blocking access to the curbside, resulting in delays ranging from 9 to 14 minutes.
- Access to far end of curbside particularly congested, with 17-minute delays during peak hours.
- Entire curbside area experiencing vehicular weaving conflicts, with the average speed of vehicles approximately 2-3 miles per hour.
- Vehicles at curbside locked in for up to 5 minutes before entering traffic lanes.

However inconvenient, it is not anticipated that these conditions would constitute an absolute constraint to airport service. Passengers tend to adapt to inadequate curbspace, such as taking shuttles from remote parking lots or utilizing available transit opportunities.

III. John Wayne Airport

Gate Capacity

An analysis was recently completed by P&D technologies of the existing John Wayne Airport terminal capacity, for the Airport System Master Plan for John Wayne Airport and Proposed Orange County International Airport (December, 1999). The analysis concluded that a gate utilization rate of about 600,000 passengers per gate was the maximum the airport could accommodate at its 14 jet gates. The gate utilization rate in 1997 was 550,000 passengers per jet gate, which was one of the highest in the country. At a maximum utilization rate of 600,000 passengers per gate, the 14 gates at the airport translates to a maximum gate capacity of 8.4 MAP.

SCAG staff evaluated why a lower maximum gate utilization rate would be justified at John Wayne Airport compared to the maximum 670,000 passengers per gate estimated for Burbank Airport. It was concluded that difference was justified, for the following reasons:

- The current fleet mix of passenger air carrier aircraft Burbank is comprised of 92% Boeing 737's (70 out of 76 flights). At John Wayne Airport, 737's make up 59% of total air carrier passenger flights. These aircraft are almost exclusively operated by discount carriers such as Southwest that have a much higher gate utilization rate than the average (up to twice as high in the case of Southwest, which operates 77% of the passenger flights at Burbank Airport). The greater percentage of discount carriers at Burbank Airport compared to John Wayne justifies a higher maximum gate utilization rate.
- Current overall passenger load factor at Burbank Airport is 70%, compared to 61% at John Wayne Airport. Passenger load factors at John Wayne are not expected to grow appreciably higher in the future due to the airport's very short 5700-foot main runway in combination with the airport's severe single-event noise limitations, which together impose weight restrictions on departing aircraft. The 14.8% higher overall load factor at Burbank Airport is enough by itself to justify its 11.7% higher maximum gate utilization rate compared to John Wayne Airport.

Terminal and Curbside Capacity

It was determined that existing terminal space and curbside capacity at John Wayne Airport's new terminal complex was more than sufficient to handle the airport's gate capacity of 8.4 MAP.

FINAL

Existing Physical Capacity of Los Angeles International Airport (LAX)

2/14/00

I. Introduction

The purpose of this paper is to present an overview of a recent evaluation of the existing physical capacity of Los Angeles International Airport (LAX), performed by the consulting firm ATS for the SCAG Aviation Program's 2000 Regional Aviation System Study. This work was performed in response to the adoption by the SCAG Aviation Task Force, at its November 1999 meeting, of four new aviation system scenarios that constrained a number of airports to their existing physical capacity. Rather than assuming an unenforceable policy constraint, or an undocumented or obsolete capacity figure, new capacity levels were estimated using the most current information available. Airports that were the focus of this analysis included LAX, Burbank, John Wayne and Ontario airports. This paper summarizes the results for LAX, including an analysis of the capacity impacts of proposed master plan improvements (Alternative C – no new runway). Supplementary technical documentation of the analysis is attached.

It should be noted at the outset that time and budgetary constraints did not permit a comprehensive facilities capacity analysis for the airports that were examined. Existing data and analyses provided by individual airports were relied upon to a large degree, providing they were deemed relevant and contemporary.

II. Gate Capacity

Current (1996) maximum (saturated) gate capacity was estimated using the RADAM Gate Flow Model that measures the passenger flow characteristics for different types of gates serving different aircraft types, for both peak and off-peak hours. For a design service level of "C", it is estimated that current total gate capacity at LAX is about 86.1 MAP. For 2020 with proposed master plan improvements (Alternative C), assuming a design service level of "C", total gate capacity at LAX was estimated to reach 99.9 MAP. Assuming a design service level of "F" (worst level), total gate capacity with the same improvements reached 107.4 MAP.

As explained below, existing gate capacity was not determined to be the constraining capacity factor since it is superceded by limited runway capacity.

III. Runway Capacity

Very briefly, the assessment of runway capacity at LAX involved this sequence of analytical steps:

- Future aircraft operations and load factors at LAX were derived from unconstrained RADAM forecasts in conjunction with data from the LAX Master Plan about the types of aircraft (fleet mix) that are forecast to be operational in 2015
- Forecast aircraft operations by aircraft type were distributed by the RADAM model by hour of day
- The breakdown of operations by instrument flight rules (IFR) and visual flights rules (VFR) was derived from data from SIMMOD airspace model runs provided by LAX master plan consultants
- Two primary arrival streams were assumed, using outboard runways
- FAA aircraft separation standards were assumed, slightly modified to reflect more conservative airline/pilot behavior
- When unacceptable delays occurred during peak periods according to runway acceptance limitations, operations were spread to off-peak periods within the range of tolerance of expressed passenger preferences for travel times (and reflecting nighttime contraflow constraints)
- Total aircraft arrivals per day were computed for air carrier and commuter aircraft
- Total arrivals were multiplied by two, by 365, by aircraft seating capacities and lastly by forecast load factors to derive total passengers or MAP.

Results of the runway capacity analysis for existing facilities are as follows:

Air carrier load factor:	65%
Daily air carrier arrivals:	692
Daily air carrier passengers:	103,831
Yearly air carrier passengers:	75.67 MAP
Commuter load factor:	45%
Daily commuter arrivals:	234
Daily commuter passengers:	3,218
Yearly commuter passengers:	2.35 MAP
Total runway capacity:	**78.02 MAP**

Results of the runway capacity analysis for existing facilities + master plan improvements (i.e., relocations of outboard runways and extensions of three of the four runways, but no new runways) are as follows:

Air carrier load factor:	66%
Daily air carrier arrivals:	835
Daily air carrier passengers:	115,618
Yearly air carrier passengers:	84.40 MAP
Commuter load factor:	60%
Daily commuter arrivals:	136
Daily commuter passengers:	2,740
Yearly commuter passengers:	2.00 MAP
Total runway capacity:	**86.40 MAP**

2020 PROJECTED LAX FLEET MIX

The passenger aircraft fleet mix at an airport is a function of the level of passenger demand by passenger type, as well as by equipment projected to be available to support each of the passenger demand categories. Passenger demand falls into the following broad categories:

Domestic Service:

- Commuter
- Short Haul
- Medium Haul
- Long Haul
- Connecting domestic to domestic (Connecting can be between each of the categories except, for only a few rare cases, between commuter and commuter)

International Service:

- Latin America
- Atlantic
- Pacific Rim
- Canada/Mexico
- Connecting international to international
- Connecting domestic/international

Generally, airports grew sequentially, initially serving commuter traffic, which requires little in way of facilities and offers more rapid financial amortization of initial investment. This is followed by short haul, medium haul and long haul, as the airport grows in size. It is unlikely that an airport can exist in the U.S. without some reflection of this pattern, as commuter and short haul often provide feeder service for long haul and international destinations. International service is offered only larger airports, with sufficient critical mass in domestic passenger service to support international operations. The longer haul operations characteristically require larger aircraft, resulting in more passengers pre operation.

The particular aircraft fleet mix developed for LAX as part of this estimation methodology relied on the projected passenger demand ascertained in the scenario.

The particular scenario selected for this analysis used the following assumptions in terms of equipment, seating capacities and load factors.

It is anticipated that as airports become more constrained in terms of allowable flights per hour, that airlines will invariably field larger aircraft in order to growing passenger demand. However, airlines have expressed some reservation about the rapid replacement of current fleets, particularly airlines whose niche includes high frequency short haul service.

Commuter Aircraft, Regional Service

11-30 Seats:

Representative aircraft designed for this segment of the passenger market include:
Jetstream J131, Beechcraft 1900, and the Embraer Brasalia series. These have been included in the year 2020 daily operations forecasts by aircraft type.

32-60 Seats:

Representative aircraft serving primarily short haul passengers include ATR 42, DeHavilland DHC8-100/200/300 series, as well as Canadaair Regional Jet. These have been considered in daily operations allocations.

61-90 Seats:

Representative equipment serving short haul service includes the ATR 72, DeHavilland DHC8-400 series and the Fokker 70 jet.

Air Carrier Aircraft (National and International Service)

91-120 Seats:

Representative aircraft serving domestic and potentially medium haul international service include the Boeing series 737-200/500/600 and Boeing 717 (MD 95 jet).

121-170 Seats:

Representative aircraft include again the Boeing 737 in the 300/400/700/800 configuration as well as Airbus 320, and the McDonnell Douglas MD 80/90 series.

171-200 Seats:

Typically a Boeing 757 class aircraft

201-375 Seats:

This would include representations of Boeing 767 and the Larger Boeing 777; Airbus entry would be the Airbus 300 series as well as the MD 11 from McDonnell Douglas.

375 Plus Seats:

This category includes existing as well as future aircraft primarily designed for long haul and international service. Existing aircraft would include the Boeing 747 as well as Airbus 3XX and Boeing 7XX future equipment.

AIRCRAFT FLEET MIX RAMIFICATIONS

On terms of the annual service volume (ASV) one of the critical factors is the projected aircraft mix. It is significant in the sense that due to physical effects of wake turbulence, a minimum safe separation must be observed between aircraft. These intrail separations are particularly critical for dissimilar aircraft type. The longest separation that needs to be observed occurs when a large, class D aircraft (i.e. a Boeing 777, B747, L1011, or airbus 3XX) is followed by a small class A or B aircraft (less than 12,500 LB takeoff weight).

Fleet mix may also be a constraining factor in terms of flow along the taxiway complex and gates. The geometric requirements of larger jest are significantly different from the aprons designed to accommodate smaller commuter (class A) aircraft. However, due to the very limited scope of this estimation effort, a detailed analysis of the aircraft flows along the taxiways was not undertaken.

In estimating LAX' future performance in terms of passengers, the assumed fleet mix is a critical assumption. To maximize the passenger carrying capacity, larger aircraft will provide significantly greater passenger capacity compared with smaller aircraft with equal load factors.

For example, a class D aircraft such as a Boeing 747 with 440 seats, will carry 286 passengers at a load factor of only 65%. To carry the same number of passengers an aircraft mix comprised four Boeing 737's with an average seating of 117 seats would be required.

Aircraft fleet mix is subject to certain economic replacement inertia. It is unrealistic to assume that because of constraints at one airport, that the airline industry will completely replace its aircraft fleet with higher capacity aircraft. In addition, larger aircraft may reduce the frequency of service. In telephone conversations with Southwest Airlines, a premier user to B737 class aircraft, there was considerable skepticism with regard to re-equipment of existing fleets with larger aircraft. The frequency of service was quoted as a critical niche prerequisite for short haul service.

AIRCRAFT FLEET MIX AND PASSENGER DEMAND INPUTS

In this analysis, the fleet mix was assumed to be a function of the segmentation of LAX passengers into commuter, short, medium, long and international haul categories. Each of these categories commands a specific class of aircraft based on required flight distance. The choice of specific aircraft type is more complex in that it is a matter of market strength, airline procurement strategies and operating costs.

The initial step in this analysis was to determine the passenger demand at LAX under unconstrained conditions. The scenario chose for this task allowed LAX to reach 94 MAP, of which 49.185 MAP represents domestic passengers. Domestic passenger segmentation was as follows (Table 1):

- Commuter: 5.09%
- Short haul: 44.73%
- Medium haul: 23.59%
- Long haul: 26.59%

This passenger portfolio was contrasted with average load factors, generating domestic aircraft operations by haul type. At the given load factors, which in this case were future averages (approximately 60%), it was determined that the LAX would need to accommodate 627,725 domestic operations per year. Of those, 132,461 would be low yield operations, carrying only 2.5 MAP of commuter passengers. The overall largest category is short haul carrying over 22 MAP with 277,784 operations.

Inputs in terms of international passengers were broken down by world region. RADAM 4.2 generated forecasts of passengers for all international airports given the assumed aircraft seating capacities and load factors, which varied by world region. Tables 2, 3 and 4 show the passenger and operational characteristics that were used for modeling of daily schedules by hour and aircraft type. Under these conditions, LAX would have to accommodate 44.9 million international passengers in 2020, utilizing 187,537 international flights, including origin/destination as well as international to international connecting flights.

FLEET MIX APPROACH & FINDINGS

The approach taken as far as fleet mix projections relied on data obtained from LAX Master Plan. The procurement and production of various types of aircraft are considered prior to air space modeling. The fleet mix or types of aircraft considered to be operational in the year 2020 were assumed to be similar to the fleet mix used in the 2015 Master Plan.

Initial inputs into the RADAM 4.2 model included information with regard to specific aircraft by model and manufacturer. The seating capacities of aircraft not yet in service were determined by contacting the manufacturer and a review of their specification sheets, where available. Although the RADAM 4.2 model has an extended aircraft module designed to accommodate specifications of over 200 aircraft types, its calibration limits require at least 12-air carrier and 6 commuter aircraft. This minimum threshold is easily reached by the fleet mix proposed by the LAX Master Plan.

The aircraft types input into the RADAM Model are then offered, as a surrogate of air service supply, to a projected air passenger market, on the demand side of the equation. The model is driven primarily by passenger demand in this particular model configuration. In other words, heavy weight is put on passenger travel patterns and preferences as shown in over 40,000 surveys region-wide.

Passengers are allocated to aircraft, according to the fleet mix offered, and distributed throughout the day. The result of this initial step is the distribution of operations by hour of day by aircraft type. This distribution is then processed through the runway models of RADAM. The runway models test the given operation stream in terms of arrivals, or runway acceptance. Too many aircraft operations within an hour generate delay. To minimize delay the model then gradually redistributes passenger loads and hence aircraft operations to off-peak hours. A variety of over 200 calibrations are available for the redistribution of passengers and operations. The preferred redistribution pattern is one in which an existing pattern of an airport or an initial default distribution is fed into the model and the model than makes adjustments accordingly. The redistribution pattern can be based on the following choices or a matrix of any one of the following criteria:

- Stated passenger preferences as far as arrival and departure times are concerned with emphasis on long haul and international haul operations.

- Stated passenger preferences as far as arrival and departure times are concerned with emphasis on short haul and commuter feeder service to air carrier flights

- Stated passenger preferences as far as arrival and departure times are concerned with emphasis on maximizing demand during peak hours based on larger aircraft representation.

- Stated passenger preferences as far as arrival and departure times are concerned with emphasis achieving the highest density of the arrival stream by synchronizing aircraft arrivals based on optimal separation distances.

Due to the very limited scope of this effort, RADAM modeling of daily aircraft operations by commuter and air carrier aircraft relied heavily on a pattern consistent with passenger preferences in conjunction with allocations generated through SIMMOD modeling.

Only a limited number of scenarios could be tested. The scenario which appeared to produce the least delay and still maintain general consistency with SIMMOD results generated a total annual demand of 86.4 MAP for 2020 assuming the Master Plan improvements, under Alternative 4. This operational ceiling shows a delay which is significantly higher than that generated by FAA's ASV method. However, this is typical in that the ASV approach is extremely conservative in delay computation, compared to actual conditions and other FAA models. RADAM 4.2 modeling showed that at 86.4 MAP LAX is breaching the threshold for Level of Service "F" in terms of the runway acceptance as well as taxiway and gate operations.

SUMMARY OF APPROACH & RESULTS

Passenger demand by haul type was generated using outputs from a RADAM 4.2 Scenario where LAX was assumed to be unconstrained, reaching in excess of 94 MAP. This information was then input independently into a RADAM Model responsible for generating operations forecasts by aircraft type and time of day. Aircraft types used were identical to those noted in the LAX Master Plan. The objective was to redistribute the operations in a manner similar to that, which was modeled by means of SIMMOD. Numerous scenarios were run starting with Scenario Series X, where a higher percentage of large aircraft was assumed, to Scenario Series Y with a higher percentage of smaller aircraft. After each iteration, several indicators were noted for the each scenario. After approximately 7 scenarios, a final scenario was selected on the basis of reduced delay, reasonable spread of peak hour demand (in relation to survey data) and consistency with SIMMOD modeling results.

Using this estimation methodology LAX reaches saturation levels at 78,016,744 passengers. Of those, 75.667,953 are air carrier and 2.348,791 are commuter passengers. Saturation levels in terms of operations occur recurrently causing schedule delays. Although gates provide sufficient capacity, directional conflicts and queuing at taxiway intersection cause additional delays, adversely affecting the incoming aircraft stream. This causes successive delays. Beyond 78 MAP sustained delays, significantly delaying operations will occur.

For 2020 over seven different scenarios were evaluated to determine best fit with SIMMOD results. The resulting, of Selected Scenario features a fleet mix, generating 86.4 MAP. Beyond this level of utilization, LAX should be expected to accrue sustained delays in runway acceptance as well and ongoing conflicts along taxiways.

It should be noted that the estimation technique is not a viable substitute for thorough modeling of the various airport components for their ability to constrain the flow of aircraft, passengers and ground access traffic.

AIRCRAFT OPERATIONS – IFR/VFR APPROACHES

Aircraft are operated under two types of flight rules depending on weather conditions. Visual or VFR approaches govern when weather conditions are favorable in terms of visibility allowing for visual recognition of land features and other aircraft. IFR, or instrument approach protocol applies when airport in question experiences reduced visibility or is encompassed by low cloud cover, generally below the 1000-foot ceiling. Visibility of less than 3 miles prompts IFR approach protocol, under instrument meteorological conditions (IMC). Several concomitant weather conditions including wind direction, visibility, and wind velocity factors affect runway acceptance rates. As such, prevailing weather conditions at one airport affect, to a degree, on-time arrival of aircraft at destination airports. Under generally favorable weather conditions occurring at LAX, as recorded by the National Data Climatic Center, the following breakdown of IFR and VFR approaches have been assumed to continue through the year 2020.

SEQUENTIAL ARRIVAL STREAM

A limited modeling application of RADAM Version 4.2 for estimating the sequential arrival pattern at LAX assumed the following:

- Additional capacity afforded by the two inboard runways was assumed to be available to air traffic during peak periods. This is an essential assumption, in that it strengthens the airport's ability to maintain efficient peak period (4-hour design standard) operations. According to air traffic control, sequential arrivals to the inboard runways were assumed to have a minimum of 10 nautical mile separation over the threshold.

- Sequential arrivals on the outboard runways were allowed to compress on final approach to 2.5-2.7 nautical miles under VFR west flow protocol. A separation of 2.5 miles was allowed for final approach under VFR ILS west flow. For VFR ILS east flow, closure up to 2.5 miles was allowed.

- Sequential arrival streams under IFR protocol were assumed to be optimized to provide adequate departure stream capacity.

- However, for both the east and west flows, the minimum separations as dictated by wake turbulence safety restrictions were observed.

SEQUENTIAL DEPARTURE STREAM

The following assumptions were made with regard to the synchronization of departure and arrival streams:

- VFR departures were modeled independently of arrivals on the close parallel runways in the SIMMOD analysis conducted by the Master Plan. This assumption was maintained in this analysis.

- Successive west flow departures utilizing the same runway complex or the same runway were assumed to occur "in trial to coast line" following a jet aircraft. For turboprop aircraft, in trail to the LAX VOR were assumed.

- Successive east flow departures from the same runway complex or same runway were also assumed to occur in trail to coastline following jet aircraft and intrail to LAX VOR following a turboprop aircraft.

- Synchronization of departures under IFR, occurred in coordination with arrivals to the close parallel runway. Clearance for take-off given upon arrival having closing the threshold.

CROSSOVER AND NIGHTTIME OPERATIONS

SIMMOD modeling conducted by LAX Master Plan assumed east flow, successive departures from same complex or runway, to be intrail to the 3 DME (Distance measuring Equipment) arc from the LAX VOR, corresponding to approximately 1 nautical mile from the end of 24R/24L runways.

Although intrail departure to EXERT and DAGGET fixes are greater than standard separations, the respective 7 and 5 mile separations were not included in the modeling of the daily arrival stream in RADAM 4.2.

Crossover departures between the north and the south complex were allowed to occur, to maximize capacity. As such, departures form the north complex to a fix along the southbound route were allowed to occur, the same as south complex departures to a fix along the northbound route.

The over the ocean alternative operations stipulated in the Master Plan from 24:00 to 6:30 A.M. aimed at reducing noise impacts, were assumed to occur but did not play a role in the capacity estimation. This would be the case if a substantial portion of air traffic were shifted to nighttime, which is not the case. Although theoretically it is possible to spread airline schedules evenly over the 24 hours, it was assumed that this would not be acceptable by the public, and hence not a viable option for capacity expansion.

Additional procedures assumed for non-intrail jet departures in the non-heavy category were assumed to be not less than 55-60 seconds. On January 22, 200 several observations at LAX showed the following values:

Observed successive non-heavy non intrail departures were as follows:

Departure 1: 65 seconds
Departure 2: 70 seconds
Departure 3: 58 seconds
Departure 4: 68 seconds

Departure 5: 75 seconds
Departure 6: 74 seconds

The average observed non-in trail departures averaged 68.3 seconds. This information was used in conjunction with the final approach velocity of aircraft was used for departure estimation.

Departures of heavy aircraft limit the next departure using the same runway or adjacent parallel runway by 105-120 minutes. Observations of successive heavy departures yielded the following results on January 22, 2000.

Heavy Departure 1: 127 seconds
Heavy Departure 2: 110 seconds
Heavy Departure 3: 109 seconds
Heavy Departure 4: 117 seconds
Heavy Departure 5: 118 seconds

The resulting average of 116 seconds was used for the capacity estimation methodology.

LATIN AMERICA 2020 LAX UNCONSTRAINED SCENARIO

MILLION ANNUAL PASSENGERS	11.539569			
	LAX	ONT	ELT	TOTAL
PERCENT PX BY AIRPORT	0.693972	0.219283	0.086745	1
MAP BY AIRPORT	10.385475	0.690344	0.463750	11.5395687
AVERAGE PX LOAD FACTOR	**0.61**	0.61	0.61	
SEATING CAPACITY	280	275	277	
PASSENGERS PER OPERATION	175	175	175	
ANNUAL AVERAGE OPERATIONS	59,346	3,945	2,650	65,940
INITIAL INPUT OPERATIONS	60,000	4,000	3,000	67,000

ATLANTIC 2020 LAX UNCONSTRAINED SCENARIO

MILLION ANNUAL PASSENGERS	10.023331			
	LAX	ONT	ELT	TOTAL
PERCENT PX BY AIRPORT	0.708024	0.043100	0.248876	1
MAP BY AIRPORT	8.804933	0.112755	1.105643	10.023331
AVERAGE PX LOAD FACTOR	**0.75**	0.75	0.75	
SEATING CAPACITY	320	295	320	
PASSENGERS PER OPERATION	240	221	240	
ANNUAL AVERAGE OPERATIONS	36,687	510	4,607	41,804
INITIAL INPUT OPERATIONS	38,000	1,000	5,000	44,000

ASIA   2020 LAX UNCONSTRAINED SCENARIO

MILLION ANNUAL PASSENGERS	26.290547			
	LAX	ONT	ELT	TOTAL
PERCENT PX BY AIRPORT	0.665043	0.034958	0.299999	1
MAP BY AIRPORT	22.428276	0.248012	3.614258	26.290547
AVERAGE PX LOAD FACTOR	**0.74**	0.74	0.74	
SEATING CAPACITY	420	420	420	
PASSENGERS PER OPERATION	320	295	320	
ANNUAL AVERAGE OPERATIONS	70,088	841	11,295	82,224
INITIAL INPUT OPERATIONS	71,000	1,000	12,000	84,000

CANADA   2020 LAX UNCONSTRAINED SCENARIO

MILLION ANNUAL PASSENGERS	1.263921			
	LAX	ONT	ELT	TOTAL
PERCENT PX BY AIRPORT	0.638800	0.124454	0.236746	1
MAP BY AIRPORT	1.077163	0.044147	0.142611	1.263921
AVERAGE PX LOAD FACTOR	**0.65**	0.65	0.65	
SEATING CAPACITY	178	170	175	
PASSENGERS PER OPERATION	116	111	114	
ANNUAL AVERAGE OPERATIONS	9,310	400	1,254	10,963
INITIAL INPUT OPERATIONS	10,000	1,000	1,500	12,500

INT CONNECTING 2020 LAX UNCONSTRAINED SCENARIO

MILLION ANNUAL PASSENGERS	2.41411			
	LAX	ONT	ELT	TOTAL
PERCENT PX BY AIRPORT	0.872982	0.014254	0.112764	1
MAP BY AIRPORT	2.300073	0.007901	0.106135	2.414109
AVERAGE PX LOAD FACTOR	**0.674**	0.674	0.674	
SEATING CAPACITY	268	268	268	
PASSENGERS PER OPERATION	190	180	187	
ANNUAL AVERAGE OPERATIONS	12,106	44	568	12,717
INITIAL INPUT OPERATIONS	12,700	500	1,000	14,200

SUMMARY

LAX UNCONSTRAINED SCENARIO

AIRPORT TOTALS	***LAX***	***ONT***	***ELT***	***TOTAL***
MILLION ANNUAL PASSENGERS	44.995920	1.103158	5.432397	51.531475
INTERNATIONAL OPERATIONS	187,537	5,739	20,373	213,648

1998 LAX AIRCRAFT OPERATIONS BY HOUR

ARRIVAL STREAM SELECTED SCENARIO

AIR CARRIER AIRCRAFT

HOUR	100	300	310	320/ 319	330	340	733	734	735	737	73S	744	747	74M	74X	757	763	767	777	AB3	D10	M11	M80/ 85	M87	M90	M95	
ending																											
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	2
2	0	0	0	0	0	0	1	0	0	0	0	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	4
3	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	5
4	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4
5	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	5
6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	0	0	0	0	5
7	0	1	0	1	1	1	0	0	0	2	0	0	1	0	1	1	1	1	0	0	0	2	0	0	0	0	10
8	0	0	0	1	0	0	1	0	1	1	0	1	0	1	1	5	0	1	0	0	0	1	0	1	0	1	13
9	0	0	1	1	0	1	2	1	1	1	0	2	1	2	1	6	0	0	0	1	0	1	0	0	1	0	22
10	0	0	1	1	0	1	2	1	0	3	1	4	2	4	3	7	1	1	0	2	0	4	1	0	0	1	39
11	0	0	1	2	1	1	1	1	1	7	1	5	2	5	5	6	1	1	0	3	0	9	1	0	1	2	56
12	0	0	0	2	1	1	4	1	2	7	0	2	4	6	5	5	2	2	0	2	0	10	2	0	2	1	60
13	0	0	0	3	1	1	2	2	1	6	1	3	5	8	2	5	1	1	0	1	0	11	1	0	1	0	56
14	0	0	1	2	2	0	3	0	1	6	0	2	5	3	2	4	1	2	0	2	0	4	1	0	0	0	39
15	0	0	1	0	1	2	1	0	0	3	0	1	2	1	1	5	2	2	0	1	1	2	2	0	1	0	27
16	0	0	1	0	1	1	2	2	1	3	1	3	1	1	1	5	1	2	0	2	0	1	2	0	1	1	30
17	0	0	0	0	0	0	5	1	1	1	1	1	1	0	0	6	2	1	0	1	1	7	2	0	2	0	31
18	0	0	2	2	2	0	5	1	0	2	1	1	2	0	0	9	1	3	0	3	1	8	1	0	1	1	45
19	1	0	3	2	1	0	5	1	1	5	0	3	5	5	2	8	2	5	0	2	0	9	1	0	1	1	62
20	1	0	3	3	0	2	2	0	0	7	0	5	7	7	5	6	1	1	0	2	0	8	2	1	0	1	63
21	0	0	1	2	1	2	3	1	1	6	1	5	6	3	3	2	2	2	0	2	0	3	1	1	1	0	48
22	0	0	0	1	1	2	2	1	1	3	0	1	4	0	0	2	2	2	0	5	0	1	2	0	1	1	33
23	0	0	1	0	0	0	4	1	3	2	1	0	2	0	0	1	2	2	0	2	0	1	2	0	1	0	24
24	0	0	0	0	0	0	3	2	0	0	1	1	0	0	0	1	0	1	0	1	0	0	0	0	0	1	9
TOTAL	1	2	14	23	10	13	49	15	12	73	6	42	52	45	30	89	21	31	-	34	5	82	20	2	12	10	692
Seats	63	297	252	153	396	302	115	115	115	117	134	170	379	407	407	212	162	218	396	70	342	365	130	125	137	135	
LF	0.51	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	
PX/OP	32	193	164	99	257	196	75	75	75	76	87	111	246	264	264	137	105	142	257	46	222	237	84	81	89	88	
DAILY PX	32	386	2,296	2,277	2,570	2,548	3,675	1,125	900	5,548	522	4,662	12,792	11,880	7,920	12,193	2,205	4,402	-	1,564	1,110	19,434	1,680	162	1,068	880	103,831

TOTAL AIR CARRIER	MAP	75,667,953

HOUR:Hour ending
Seats:Seats available for passengers (minus air crews)
LF: Average annual load factors
PX/OP:Passengers per operation
% PX: Percentage of passengers carried by particular aircraft time (daily average)
Daily PX:Daily arrival passengers carried

1998 COMMUTER AIRCRAFT OPERATIONS
ARRIVAL STREAM BY AIRCRAFT TYPE

COMMUTER AIRCRAFT

HOUR Ending	AT7	ATR 42/72	BE1	C50	C70	CAN	DS7/8	EM2	EMB	F50	F70	GA1	131	S20	S36	SF3	SWM	TOTAL
1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1	0	0	4	0	1	2	0	0	1	2	3	0	2	1	15
8	0	1	1	2	0	4	1	1	1	0	0	0	1	2	0	1	1	16
9	1	1	2	1	0	4	1	1	0	0	0	0	0	2	0	1	2	15
10	0	2	1	1	1	3	1	1	0	0	0	0	1	1	0	1	1	13
11	0	3	0	2	0	3	1	0	1	0	0	1	1	0	0	1	2	15
12	1	3	0	1	1	1	0	1	0	1	0	0	1	0	0	1	2	13
13	0	4	0	1	0	1	2	0	0	1	0	0	1	1	0	0	1	12
14	0	2	1	1	0	1	0	0	0	2	0	1	0	2	1	1	0	12
15	0	2	2	0	0	3	3	1	1	0	0	1	1	2	0	1	2	20
16	0	3	0	0	0	4	1	1	0	0	0	2	0	3	0	0	1	15
17	1	3	0	0	0	4	0	0	0	0	0	1	1	1	0	0	1	14
18	1	2	2	0	0	5	3	1	0	0	0	1	1	3	0	0	1	20
19	1	1	1	3	0	6	1	0	0	0	1	1	1	0	1	1	1	18
20	0	0	0	1	0	3	0	1	0	0	0	0	1	2	0	0	2	12
21	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	2	1	8
22	1	0	0	0	0	1	0	1	2	0	0	0	2	0	0	0	1	8
23	0	1	3	0	0	1	0	0	0	0	0	0	1	0	0	0	0	5
24	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	5	28	13	12	3	48	13	9	6	4	2	8	13	20	2	11	18	234
Seats	46	46	17	46	20	20	46	19	28	52	29	17	29	46	29	28	47	
LF	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
PX/OP	21	21	8	21	9	9	21	9	12	24	13	8	13	21	13	12	21	
PX	109	579	102	255	24	430	273	76	77	91	23	61	171	419	23	132	372	3,218
% PX																		

TOTAL COMMUTER PX	2,348,791

Seats: average seating minus crew
LF: Average annual load factors
PX/OP: Passengers per operation
% PX: Percentage of passengers carried by particular aircraft time (daily average)

2020 LAX AIRCRAFT OPERATIONS BY HOUR
ARRIVAL STREAM

AIR CARRIER AIRCRAFT

HOUR ending	100	300	310	320/319	330	340	733	734	735	737	73S	744	747	74M	74X	757	763	767	777	AB3	D10	M11	M80	M87	M90	M95	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	1	0	0	0	4
2	0	0	0	0	0	0	1	0	0	0	0	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	6
3	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	4
4	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	4
5	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	6
6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	1	0	0	0	0	0	9
7	0	1	0	0	1	1	0	0	0	2	0	0	1	0	0	2	1	2	1	0	0	3	0	0	0	0	14
8	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	16	0	1	1	0	0	1	0	1	0	1	24
9	0	0	1	0	0	1	4	1	1	0	0	4	1	3	2	16	0	0	0	2	0	2	0	0	1	0	37
10	0	0	1	0	0	2	4	2	0	2	1	6	0	1	1	20	2	1	2	3	0	4	2	0	0	1	53
11	0	0	2	0	1	2	2	2	2	0	1	7	0	0	1	17	2	1	3	5	0	10	2	0	1	4	62
12	0	0	0	0	1	2	6	1	3	1	0	4	0	0	2	11	3	3	6	3	0	9	6	0	3	2	64
13	0	0	0	0	1	1	3	3	2	0	2	6	0	1	2	8	1	1	3	2	0	4	1	0	1	0	40
14	0	0	1	0	3	0	5	0	1	0	0	3	1	2	0	6	2	4	4	3	0	8	1	0	0	0	42
15	0	0	1	0	1	3	2	0	0	0	0	2	0	1	1	17	4	3	2	1	1	6	3	0	2	0	48
16	0	0	1	0	1	1	3	3	1	0	2	6	2	1	1	16	1	3	1	4	0	2	3	0	2	1	51
17	0	0	0	0	0	0	6	1	1	0	1	2	0	0	0	9	4	2	2	1	1	9	6	0	3	0	47
18	1	0	4	0	4	0	6	2	0	0	1	1	0	0	0	18	2	5	1	6	2	3	3	0	1	2	59
19	1	0	1	0	1	0	6	2	1	1	0	6	2	1	2	12	3	4	0	4	0	1	3	0	2	1	51
20	0	0	0	0	0	1	3	0	0	3	0	8	1	0	2	17	1	2	2	4	0	0	4	1	0	1	48
21	0	0	2	1	1	2	6	2	1	1	1	7	0	0	1	14	4	4	3	4	0	4	2	1	2	0	60
22	0	0	0	0	2	1	4	2	2	0	0	2	0	0	0	9	4	4	3	7	0	2	4	0	1	2	47
23	0	0	1	0	0	0	6	1	5	0	1	0	1	0	0	5	3	4	4	4	0	1	4	0	2	0	40
24	0	0	0	0	0	0	5	3	0	0	1	1	0	0	0	1	0	2	0	1	0	0	3	0	0	2	17
TOTAL	2	4	14	1	16	16	72	23	19	12	10	66	12	9	14	220	34	45	38	53	7	68	44	3	19	16	835
Seats	63	297	252	153	396	302	115	115	115	117	134	170	379	407	407	212	162	218	396	70	342	365	130	125	137	135	
LF	0.45	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	
PX/OP	28	196	166	101	261	199	76	76	76	77	88	112	250	268	268	140	107	144	261	46	226	241	86	83	90	89	

DAILY

	100	300	310	320/319	330	340	733	734	735	737	73S	744	747	74M	74X	757	763	767	777	AB3	D10	M11	M80	M87	M90	M95	TOTAL
PX	52	720	2,292	93	4,082	3,108	5,448	1,746	1,467	922	894	7,426	2,987	2,467	3,700	30,649	3,634	6,471	9,844	2,469	1,659	16,355	3,772	228	1,742	1,392	115,618
%PX																											

TOTAL AIR CARRIER MAP	*84,401,212*

HOUR: Hour ending
Seats: Seats available for passengers (minus air crews)
LF: Average annual load factors
PX/OP: Passengers per operation
%PX: Percentage of passengers carried by particular aircraft time (daily average)

2020 COMMUTER AIRCRAFT OPERATIONS
ARRIVAL STREAM BY AIRCRAFT TYPE

COMMUTER AIRCRAFT

HOUR Ending	AT7	ATR 42/72	BE1	C50	C70	CAN	DS7/8	EM2	EMB	F50	F70	GA1	131	S20	S36	SF3	SWM	TOTAL
1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1	0	0	1	0	1	1	0	0	1	1	2	0	1	1	10
8	0	1	0	1	0	1	1	1	1	0	0	0	1	0	0	1	1	7
9	1	0	1	1	0	1	1	1	0	0	0	0	0	1	0	1	1	6
10	0	0	1	1	1	2	1	1	0	0	0	0	1	0	0	1	1	7
11	0	0	1	1	0	2	1	0	1	0	0	1	1	0	0	1	1	8
12	1	1	0	1	1	1	0	1	0	1	0	0	1	1	0	1	1	9
13	0	0	0	1	0	2	1	0	0	1	0	0	1	0	0	0	1	6
14	1	1	1	1	0	2	0	0	0	1	0	1	0	1	0	0	0	7
15	0	1	1	0	0	2	2	1	1	0	0	1	1	1	1	1	1	12
16	0	1	0	0	0	2	1	1	0	0	0	1	0	1	0	1	1	7
17	1	1	0	0	0	2	0	0	0	0	0	1	1	1	0	0	1	7
18	1	0	1	0	0	2	2	1	0	0	0	1	1	2	0	0	1	10
19	1	0	1	2	0	2	1	0	0	0	1	1	1	0	1	1	1	10
20	0	1	0	1	0	3	0	1	0	0	0	0	1	2	0	0	1	9
21	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	1	1	7
22	1	1	0	0	0	2	0	1	1	0	0	0	1	0	0	0	1	8
23	0	1	2	0	0	1	0	0	0	0	0	0	1	0	0	0	0	5
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	10	10	9	2	31	9	6	4	3	1	6	9	11	1	7	13	136
Seats	48	48	18	48	21	21	48	20	29	55	30	18	30	48	30	29	49	
LF	0.45	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	
PX/OP	21	29	11	29	13	13	29	12	17	33	18	11	18	29	18	17	30	
PX	92	280	106	245	23	385	263	74	74	102	22	60	168	315	22	126	382	2,740
% PX																		

TOTAL COMMUTER PASSENGERS 2,000,011

Seats: average seating minus crew
LF: Average annual load factors
PX/OP: Passengers per operation
% PX: Percentage of passengers carried by particular aircraft time (daily average)

SEQUENTIAL AIRCRAFT SEPARATIONS ASSUMED FOR LAX

IFR IN TRAIL SEPARATIONS (NAUTICAL MILES)

LEAD ACFT CATEGORY	SMALL			LARGE			B 757 TYPE			HEAVY		
TRAIL ACFT CATEGORY	Minimum	Base	Maximum	Minimum	Base	Maximum	Minimum	Base	Maximum	Minimum	Base	Maximum
SMALL	3.0	3.0	3.3	3.8	4.2	4.6	5.0	5.4	6.0	6.2	6.6	7.2
LARGE	3.0	3.0	3.3	3.0	3.0	3.0	4.0	4.2	4.6	5.2	5.5	6.0
B757 TYPE	3.0	3.0	3.3	3.0	3.0	3.0	4.0	4.2	4.6	5.2	5.5	6.0
HEAVY	3.0	3.0	3.3	3.0	3.0	3.0	4.0	4.2	4.6	4.2	4.5	4.9

Base: base value or nominal value

Aircraft categories are based on maximum take-off weight; An average of the aircraft take-off weights are used within each category.

Small aircraft: Aircraft weighting less than 41,000 lbs.

Large Aircraft: Aircraft weighting between 41,000 and 255,000 lbs.

B 757 type: Aircraft such as a Boeing 757

Heavy: Aircraft weighing more than 255,000 lbs.

Source: FAA, January 2000

RADAM 4.2 REGIONAL AIRPORT DEMAND ALLOCATION MODEL

2020 LAX UNCONSTRAINED SCENARIO

LAX

DOMESTIC AIRCRAFT OPERATIONS

PASSENGERS (MAP)	% HAUL	PX BY HAUL	LOAD F	SEATS	YR OP'S	YR OP'S	DAILY OP	% OP
COMMUTER	5.09	2,503,521	0.45	42	132,461		363	
SHORT	44.73	22,000,492	0.60	132	277,784	410,245	761	0.65
MEDIUM	23.59	11,602,763	0.60	171	113,087	113,087	310	0.18
LONG	26.59	13,078,316	0.58	216	104,393	104,393	286	0.17
TOTAL/AVERAGE		***49.185092***			627,725	627,725	1,720	

SUMMARY: 2020 LAX UNCONSTRAINED SCENARIO

YEARLY COMMUTER OP'S:	132,461
YEARLY AIR CARRIER OP'S:	495,264
TOTAL YEARLY OP'S:	627,725
DAILY COMMUTER OP'S:	363
DAILY AIR CARRIER OP'S:	1,357
TOTAL DAILY OP'S:	1,720

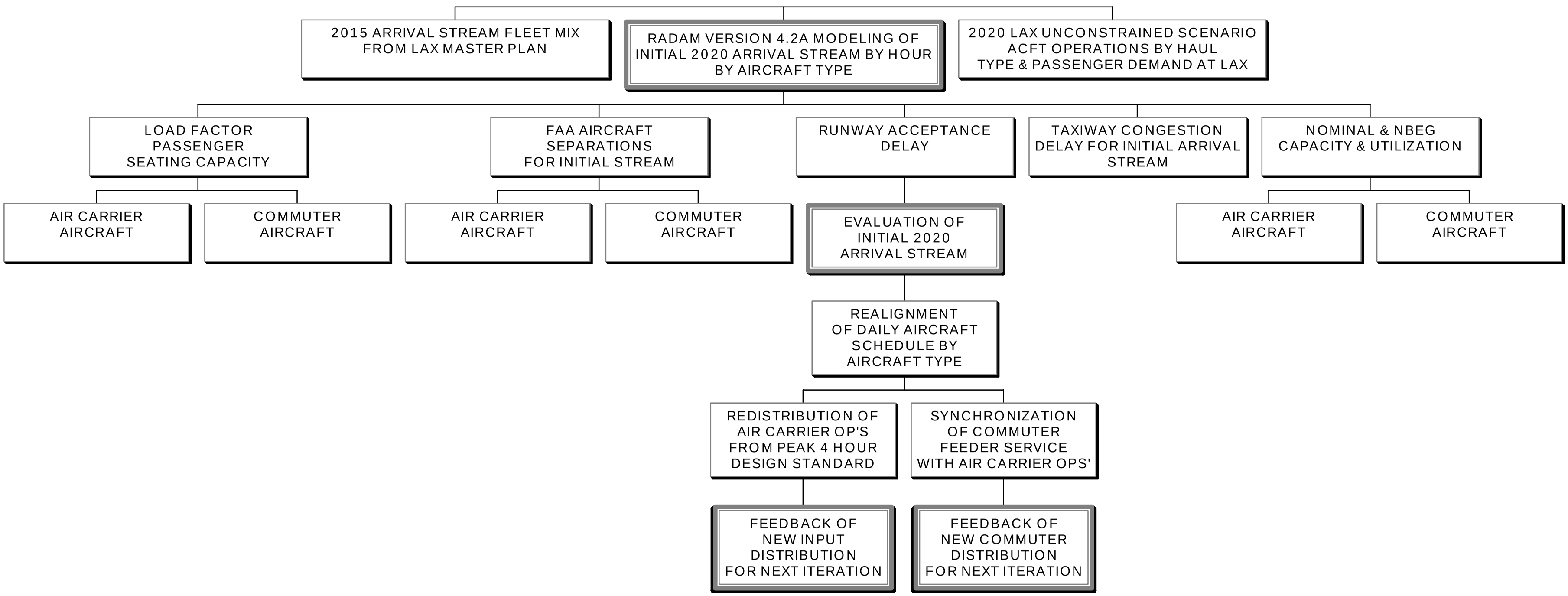
DOMESTIC AND INTERNATIONAL GATES BY TYPE AND AIRCRAFT GROUP

DOMESTIC AND INTERNATIONAL GATES	1996	1996	2015	2015	2020	2020
	NOMINAL	NBEG	NOMINAL	NBEG	NOMINAL	NBEG
Commuter group I	45	18	5	2	5	2
Commuter group II	0	0	15	10.5	15	11
Commuter group III	0	0	5	5	5	5
Narrowbody group III	34	34	32	32	31	31
Group IIIa (B 757 equivalent)	10	11	20	22	21	23
Widebody group IV	38	57	40	60	40	60
Group V (A 340, B 747equivalent)	38	64.6	50	85	50	85
Group VI, Future Large Acft	0	0	5	11.5	5	12
	165	185	172	228	172	229
INTERNATIONAL GATES						
Narrowbody group III	7	7	8	8	7	7
Group IIIa (B 757 equivalent)	1	1.1	5	5.5	6	6
Widebody group IV	8	12	20	30	20	30
Group V (A 340, B 747equivalent)	41	69.7	40	68	40	68
Group VI, Future Large Acft	0	0	5	11.5	5	12
	57	89.8	78	123	78	123

Source: 1996 and 2015 data LADOT, Landrum & Brown
2020 Data ATS Advanced Transportation Systems

LAX Operations by Aircraft by Hour Approach

GENERAL OUTLINE OF ARRIVAL STREAM ESTIMATION



WAKE VORTEX IFR ARRIVAL SEPARATIONS

AIRCRAFT CATEGORY	HEAVY CAT	N 757 TYPE	LARGE	TURBOPROP	PROPELLER
HEAVY AIRCRAFT	4	4	3	3	3
B 757 TYPE	5	4	3	3	3
LARGE	5	4	3	3	3
TURBOPROP	6	5	4	3	3
PROPELLER	6	5	4	3	3

Source: FAA January, 2000

Note: Nautical miles

SEQUENTIAL AIRCRAFT SEPARATIONS ASSUMED FOR LAX

VFR IN TRAIL SEPARATIONS (NAUTICAL MILES)

LEAD ACFT CATEGORY	SMALL			LARGE			B 757 TYPE			HEAVY		
TRAIL ACFT CATEGORY	Minimum	Base	Maximum	Minimum	Base	Maximum	Minimum	Base	Maximum	Minimum	Base	Maximum
SMALL	2.1	2.5	3.0	3.1	3.8	4.5	3.4	4.2	5.0	5.4	6.6	7.7
LARGE	2.1	2.5	3.0	2.1	2.5	3.0	3.0	3.7	4.4	4.5	5.5	6.4
B757 TYPE	2.1	2.5	3.0	2.1	2.5	3.0	3.0	3.7	4.4	4.5	5.5	6.4
HEAVY	2.1	2.5	3.0	2.1	2.5	3.0	3.0	3.7	4.4	3.6	4.5	5.3

Base: base value or nominal value

Aircraft categories are based on maximum take-off weight; An average of the aircraft take-off weights are used within each category.

Small aircraft: Aircraft weighting less than 41,000 lbs.

Large Aircraft: Aircraft weighting between 41,000 and 255,000 lbs.

B 757 type: Aircraft such as a Boeing 757

Heavy: Aircraft weighing more than 255,000 lbs.

Source: FAA, January 2000

AIRCRAFT GATE UTILIZATION AT LAX

ESTIMATION METHODS

Gate utilization is not a constant factor but the summation of several different events dictating the loading and unloading of passengers.

Over the years several different approaches had been developed to simulate gate performance at smaller and particularly larger airport complexes. The primary factor driving gate utilization efficiency is the schedule of daily flight operations. This information shows flight arrival and departure times by aircraft type by the hour. A four-hour design standard is used, although in some cases the standard can be tightened to less than four peak hours.

A variety of simplified procedures typically compress flight and aircraft type information into average daily statistics, yielding more or less reliable data. For complex airports at and above 60 MAP, most of the methods used, such as the square root rule, or the Parson's gate-enhancement curve, or apron area capacity estimations are too simplistic to yield operationally valid results.

More sophisticated modeling, such as full RADAM 4.0 terminal flow modeling, would be necessary for simulating year 2020 operations at LAX' complex system of gates, aprons, and taxiways.

Gate management simulation models used in industry are proprietary packages, available commercially through consultants. Simulation algorithms and optimization procedures, equations and calibrations are commonly held confidential and are undisclosed in available literature. Although some of the packages, such as the "Canadian Gate Assignment Model" or ATSIM[42] are relatively easy to use by engineers, their acquisition and operation costs are high.

[42] Airport Terminal Simulation Model

Gate efficiency increases with greater aircraft type and higher load factors. In order to carry the same amount of passengers that a large aircraft can carry (i.e. 747 with up to 400 seats), several smaller aircraft would be needed. The steady, uninterrupted loading and unloading of passengers from a larger aircraft is more efficient compared to the several smaller aircraft experiencing delays accessing and departing form the gate.

Gate utilization varies also by destination type, since passengers bound for certain destination have characteristically more carry-on luggage requiring more time when boarding the aircraft.

Gate utilization is optimized when the load factors are high for both arriving and departing flights. However, flights with higher arrival load factors are more efficient in terms of gate utilization compared to flights with higher departure load factors. This is due to processing of travel documentation at the terminal and loading of luggage and seating within the aircraft.

Gate utilization is adversely affected by general aviation, which in some cases must be displaced in order to maintain high levels of aircraft operations at an airport nearing saturation capacity.

TECHNICAL TERMINOLOGY

Several of the technical terms used are explained as follows. *"Nominal Gates"* refers to actual parking positions independently of terminal frontage configuration. *"Terminal frontage Configuration"* is the layout as viewed from the outside of the terminal, or the terminal architecture on the aircraft side of the terminal. *"Narrowbody Equivalent Gates"* is used as a common denominator for gates at dissimilar terminal frontages. NBEG is based on the physical size of a typical narrow body aircraft now in service with an allowance of approximately 130-135 feet wing tip clearance.

RADAM 4.0 MODELING OF GATE CAPACITY

Modeling approaches utilize specific data with regard to airport physical layout, daily flight scheduling by aircraft type, fleet mix characteristics, load factors, destinations and so forth. The model assigns flights to gates based on the operational philosophy. The emphasis may be on minimizing the number of gates used or on a preferential assignment basis.

Full-fledged RADAM 4.0 modeling requires a host of additional critical inputs such as the number of dedicated gates, or gates that would be made available on a "first come firs serve basis". Such complex simulations are very data intensive and costly in terms of initial calibrations and subsequent use. Other considerations such as the breakdown of wide-body and non-wide body aircraft are also crucial for the analysis, as is the required apron capacity (i.e. from 1 acre for a DC 9 to 3.7-3.9 acres for a B747).

Since this effort is aimed at simply estimating the saturation limits of LAX rather than a finite analysis of its complex system of different types of gates, a very limited approach using RADAM 4.0 was selected for use. The gate utilization method used in this analysis is therefore based on a *very limited* application of RADAM's© Gate Flow Model.

The calibration of the "Gate Flow Model" of the Airport Demand Allocation Model, RADAM© Version 4.0 was based on observation made at all of the regional airports during the period from January 3, 1997 to November 1998. Both peak and off-peak gate flows were observed and recorded. The flow characteristics of aircraft gates were divided into the following categories:

- Commuter operations
- Domestic short haul
- Domestic medium haul
- International medium haul: Canada, Mexico
- Domestic long haul
- International long haul: Atlantic, Asia
- International long haul: Asia

Passenger flow rates through nominal and Equivalent Narrowbody Gates were used in the gate utilization methodology.

It is assumed that the number of gates and the entire terminal architecture of LAX will remain approximately the same from the year 2015 through 2020. The projected number of nominal and NBEG is shown in Figure 1. The terminal architecture of LAX, as depicted in future layout plans served as a basis for the analysis of selected gates at the CTA and the CTA south terminal areas.

NBEG value for smaller commuter aircraft is substantially less than the nominal number of gates (i.e. 5 nominal gates equal 2 NBEG gates). For narrowbody (Group III) aircraft, the nominal gates are roughly equivalent to NBEG gates. However, for larger aircraft, such as B 747 or Airbus 340 the equivalent NBEG gates are substantially higher than the nominal gates (i.e. 1 nominal gate could equal 1.7 NBEG gates).

Although not true gates, up to 32 remote parking spaces will be accessible by shuttle buses from the North terminals. These will add additional gate capacity particularly during peak demand periods under one the LAX alternatives.

- Number of required buses: minimum 3
- Theoretical maximum seating capacity: 55 passengers
- Effective maximum seating capacity: 47 passengers
- Frequency of service: every 10 minutes
- Average roadway speed: 35 mph
- Effective roadway speed (with delay to aircraft taxiing): 27 minutes

The modeling yielded that a design aircraft of the B737 type or equivalent with a seating capacity of 120 passengers could improve capacity by as much as 4,088,000 passengers based on the 32 remote parking spaces.
However, the overall analysis of gate utilization indicates that they are not the critical, constraining factor.

FINDINGS

As shown in Table 1, LAX has a wide spectrum of gate types ranging from Commuter Group I gate, serving small commuter type aircraft, all the way to Group VI intended for future aircraft types, many of which have as yet to be named. Group V gates are designed to accommodate a variety of Boeing 747 and similarly sized Airbus 340 aircraft.

A total of 165 nominal gates are available at LAX, which is roughly equivalent to 185 narrowbody types gates. No Group V gates are currently available at LAX.

The number of gates will increase to 172 gates by 2015, according to the LAX Master Plan. This will be equivalent to as many as 228 narrowbody type gates.
For 2020 it is assumed that LAX will retain its 2015 gate configuration, since no additional data is available. The RADAM Model rounded off narrowbody equivalent gates to 229, due to slight increase in efficiency.

In terms of international gates, LAX gate capacity of 57 nominal gates goes up to 78 nominal gates in 2015, a 36.8% increase over 1996.

Table 2 shows nominal and NBEG available at LAX in 1996, in addition to passenger flow rate (in passengers per year). The flow rates are based on empirical data and observations of saturation flow rates at selected gates at LAX. The annual flow rate was derived based on the peak hour counts. For this simplified analysis, a 15-minute peak approach was not undertaken.

The peak hour flow rates range from 157,082 passengers per nominal commuter group I gate to 473,282 annual passengers for a Boeing 747 type gate (Group V). Narrowbody flow rates vary between 177.082 to 515,653 annual passengers.

It should be noted that due to time limitations the scope of this gate utilization analysis was limited to a simplified model run using RADAM's gate model. In the absence of other, more specific variables regarding the location, aprons, waiting area, etc. the model generated only order of magnitude estimates of capacity if it were based on gates flows.

The gate capacity with the existing system is capable of processing approximately 80,063,563 passengers per year at an acceptable level of service of “C”. As such, it is not a limiting factor.

In the year 2020, the passenger flow rates differ slightly from 1996, as shown in Table 3. These differences are due to the fact that flow rates for 2020 were derived from a trend line of observations that were taken at specific gates from 1996 through 1997. These trend lines show some variation in data and thus, the 1996 flow rates were not assumed transferable.

2020 flow rates for gates at LAX range from 151,098 to 502,182 annual passengers in the nominal gate category. Again, due to absence of other qualifying data the model produced order of magnitude values. The 2020 gate system appears to be adequate to carry 99,932,417 passengers per year at the threshold of Level of Service “C/D”. As such, the 2020 gate complex is not a constraining factor.

Raising the threshold to the level of service “F” the ability of the 2020 gate system increases to over 107,448,000 passengers per year (Table 4) This exceeds the unconstrained passenger forecast for LAX under the RTP Medium Scenario (94 MAP), and is thus not a constraining factor.

Tables 5, 6 and 7 show records of observations from 1997 of the peak hour passenger flows (passengers per day) at specific gates. Some variation is inherent in flows at different gate configurations and airside geometries. In addition, some variation was observed between airlines. However, as shown in Tables 5, 6 and 7 there is a maximum limit at which passengers will progress through gates.

The average values from observations were used in Tables 2,3 and 4 to insure internal consistency. A more sophisticated RADAM analysis of gates was not undertaken as part of this project.

1996 DOMESTIC AND INTERNATIONAL PASSENGERS BY GATE TYPE
LEVEL OF SERVICE C / D OVERALL DESIGN STANDARD

	1996		YR PX FLOW RATE (x1000)		PX CAPACITY	
DOMESTIC AND INTERNATIONAL GATES	GATES		BY GATE TYPE		1996	1996
	NOMINAL	NBEG	NOMINAL	NBEG	NOMINAL	NBEG
Commuter group I	45	18	157.082	177.602	7,068,690	3,196,836
Commuter group II	0	0	207.264	214.545	-	-
Commuter group III	0	0	278.388	282.765	-	-
Narrowbody group III	34	34	355.876	355.876	12,099,784	12,099,784
Group IIIa (B 757 equivalent)	10	11	376.478	401.334	3,764,780	4,414,674
Widebody group IV	38	57	435.234	474.405	16,538,892	27,041,085
Group V (A 340, B 747equivalent)	38	64.6	472.282	515.653	17,946,716	33,311,184
	165	185			57,418,862	80,063,563

SUB TOTAL ANNUAL P› 80,063,563

1996
TOTAL GATE CAPACITY IN TERMS OF ANNUAL PASSENGERS: **TOTAL ANNUAL PX** **80,063,563**

NBEG: Narrowbody equivalent gates

1997 AIR CARRIER PASSENGER GATE FLOWS

GATE 70	AMERICAN AIRLINES
GATE 80	UNITED AIRLINES
GATE 4	US AIR

AVERAGE DAILY PASSENGER FLOW RATE

GATE TYPE: BOEING 757 EQUIVALENT GATE

Gate 71B	***Gate 80A***	***Gate4B***
1123.21	*1167.23*	*1163.24*
1,078	***1,088***	1,084
1,117	***1,126***	1,123
1,025	***1,034***	1,031
965	***973***	970
903	***911***	908
1,186	***1,196***	1,192
1,066	***1,076***	1,072
1,081	***1,091***	1,087
1,219	***1,230***	1,225
1,320	***1,332***	1,327
1,072	***1,081***	1,077
1,524	***1,537***	1,532
1,180	***1,190***	1,186
1,191	***1,202***	1,197
974	***983***	979
1,247	***1,792***	1,786
1,072	***1,082***	1,078
965	***973***	970
914	***922***	919
1,135	***1,145***	1,141
1,473	***1,486***	1,481
1,247	***1,258***	1,254
1,457	***1,686***	1,681
1,216	***1,227***	1,223
965	***973***	970
1,642	***1,656***	1,651
882	***890***	886

1,135	***1,145***	1,141
1,452	***1,537***	1,532
1,025	***1,034***	1,031
965	***973***	970
1,193	***1,203***	1,199
1,186	***1,196***	1,192
1,639	***2,226***	2,218
1,081	***1,091***	1,087
1,219	***1,230***	1,225
1,320	***1,332***	1,327
1,072	***1,081***	1,077
1,524	***1,537***	1,532
1,025	***1,034***	1,031
1,179	***1,190***	1,186
1,443	***2,049***	2,042
1,186	***1,196***	1,192
1,066	***1,076***	1,072
1,081	***1,091***	1,087
1,219	***1,230***	1,225
1,320	***1,332***	1,327
1,072	***1,081***	1,077
1,524	***1,537***	1,532
1,015	***1,024***	1,021
1,025	***1,034***	1,031
965	***973***	970
863	***871***	868
1,186	***1,196***	1,192
740	***746***	744
1,081	***1,091***	1,087
1,219	***1,230***	1,225
1,443	***2,049***	2,042
1,072	***1,081***	1,077
1,524	***1,537***	1,532
1,066	***1,076***	1,072
1,191	***1,202***	1,197
974	***983***	979
1,127	***1,136***	1,133
959	***968***	964
660	***666***	664
1,066	***1,076***	1,072
1,016	***1,025***	1,021
1,025	***1,034***	1,031
965	***973***	970
863	***871***	868
1,186	***1,196***	1,192

	1,066	***1,076***	1,072
	1,081	***1,091***	1,087
	1,614	***2,049***	2,042
	1,320	***1,332***	1,327
	1,072	***1,081***	1,077
	1,524	***1,537***	1,532
	626	***631***	629
	1,191	***1,202***	1,197
	974	***983***	979
	660	***666***	664
	627	***632***	630
	965	***973***	970
	1,016	***1,025***	1,021
	954	***962***	959
	965	***973***	970
	914	***922***	919
AVERAGE	1,123.21	1,167.23	1,163.24

1997 AIR CARRIER PASSENGER GATE FLOWS

AVERAGE DAILY PASSENGER FLOW

GATE 34 TWA AIRLINES

GATE 35 TWA AIRLINES

GATE 107 FOREIGN FLAG

GATE TYPE: BOEING 747 OR AIRBUS 340

Gate 34	*Gate 35*	*Gate107*
1389.345	*1414.234*	*1411.544*
1,334	***1,318***	1,316
1,381	***1,365***	1,362
1,268	***1,253***	1,251
1,194	***1,179***	1,177
1,117	***1,104***	1,102
1,467	***1,449***	1,447
1,319	***1,304***	1,301
1,337	***1,321***	1,319
1,508	***1,490***	1,487
1,633	***1,614***	1,611
1,326	***1,310***	1,307
1,885	***1,862***	1,859
1,459	***1,442***	1,439
1,473	***1,456***	1,453
1,205	***1,191***	1,188
1,543	***2,171***	2,167
1,326	***1,310***	1,308
1,194	***1,179***	1,177
1,131	***1,117***	1,115
1,403	***1,387***	1,384
1,822	***1,800***	1,797
1,543	***1,525***	1,522
1,802	***2,043***	2,039
1,504	***1,487***	1,484
1,194	***1,179***	1,177
2,031	***2,007***	2,003
1,091	***1,078***	1,076

1,404	***1,387***	1,384
1,796	***1,862***	1,859
1,268	***1,253***	1,251
1,194	***1,179***	1,177
1,475	***1,458***	1,455
1,467	***1,449***	1,447
2,028	***2,697***	2,692
1,337	***1,321***	1,319
1,508	***1,490***	1,487
1,633	***1,614***	1,611
1,326	***1,310***	1,307
1,885	***1,862***	1,859
1,268	***1,253***	1,251
1,459	***1,442***	1,439
1,785	***2,483***	2,478
1,467	***1,449***	1,447
1,319	***1,304***	1,301
1,337	***1,321***	1,319
1,508	***1,490***	1,487
1,633	***1,614***	1,611
1,326	***1,310***	1,307
1,885	***1,862***	1,859
1,256	***1,241***	1,238
1,268	***1,253***	1,251
1,194	***1,179***	1,177
1,068	***1,055***	1,053
1,467	***1,449***	1,447
915	***904***	902
1,337	***1,321***	1,319
1,508	***1,490***	1,487
1,785	***2,483***	2,478
1,326	***1,310***	1,307
1,885	***1,862***	1,859
1,319	***1,304***	1,301
1,473	***1,456***	1,453
1,205	***1,191***	1,188
1,393	***1,377***	1,374
1,187	***1,173***	1,170
817	***807***	805
1,319	***1,304***	1,301

	1,256	***1,241***	1,239
	1,268	***1,253***	1,251
	1,194	***1,179***	1,177
	1,068	***1,055***	1,053
	1,467	***1,449***	1,447
	1,319	***1,304***	1,301
	1,337	***1,321***	1,319
	1,996	***2,483***	2,478
	1,633	***1,614***	1,611
	1,326	***1,310***	1,307
	1,885	***1,862***	1,859
	774	***765***	763
	1,473	***1,456***	1,453
	1,205	***1,191***	1,188
	817	***807***	805
	775	***766***	765
	1,194	***1,179***	1,177
	1,256	***1,241***	1,239
	1,179	***1,165***	1,163
	1,194	***1,179***	1,177
	1,131	***1,117***	1,115
AVERAGE	*1,389.35*	*1,414.23*	*1,411.54*
OVERALL AVERAGE			1405.04

1997 AIR CARRIER PASSENGER FLOW RATES

AVERAGE DAILY PASSENGER FLOW RATE

GATE 2	SOUTHWEST AIRLINES/US AIR
GATE 4A	SOUTHWEST AIRLINES/US AIR
GATE 3A	SOUTHWEST AIRLINES

GATE TYPE: BOEING 737 CLASS

Gate 2	***Gate 4A***	***Gate 3A***
1055.324	*1032.465*	*1,050.556*
1,013	***962***	979
1,049	***996***	1,014
963	***915***	931
907	***861***	876
849	***806***	820
1,114	***1,058***	1,077
1,002	***952***	968
1,016	***965***	982
1,145	***1,088***	1,107
1,241	***1,178***	1,199
1,007	***956***	973
1,431	***1,359***	1,383
1,109	***1,053***	1,071
1,119	***1,063***	1,081
915	***869***	884
1,172	***1,585***	1,613
1,007	***957***	973
907	***861***	876
859	***816***	830
1,066	***1,012***	1,030
1,384	***1,314***	1,337
1,172	***1,113***	1,132
1,369	***1,492***	1,518
1,143	***1,085***	1,104
907	***861***	876
1,543	***1,465***	1,491
828	***787***	801

1,066	***1,013***	1,030
1,364	***1,359***	1,383
963	***915***	931
907	***861***	876
1,121	***1,064***	1,083
1,114	***1,058***	1,077
1,540	***1,969***	2,003
1,016	***965***	982
1,145	***1,088***	1,107
1,241	***1,178***	1,199
1,007	***956***	973
1,431	***1,359***	1,383
963	***915***	931
1,108	***1,052***	1,071
1,356	***1,813***	1,844
1,114	***1,058***	1,077
1,002	***952***	968
1,016	***965***	982
1,145	***1,088***	1,107
1,241	***1,178***	1,199
1,007	***956***	973
1,431	***1,359***	1,383
954	***906***	922
963	***915***	931
907	***861***	876
811	***770***	784
1,114	***1,058***	1,077
695	***660***	672
1,016	***965***	982
1,145	***1,088***	1,107
1,356	***1,813***	1,844
1,007	***956***	973
1,431	***1,359***	1,383
1,002	***952***	968
1,119	***1,063***	1,081
915	***869***	884
1,058	***1,005***	1,023
901	***856***	871
620	***589***	599
1,002	***952***	968

	954	***906***	922
	963	***915***	931
	907	***861***	876
	811	***770***	784
	1,114	***1,058***	1,077
	1,002	***952***	968
	1,016	***965***	982
	1,516	***1,813***	1,844
	1,241	***1,178***	1,199
	1,007	***956***	973
	1,431	***1,359***	1,383
	588	***558***	568
	1,119	***1,063***	1,081
	915	***869***	884
	620	***589***	599
	589	***559***	569
	907	***861***	876
	954	***906***	922
	896	***851***	866
	907	***861***	876
	859	***816***	830
AVERAGE	*1,055.32*	*1,032.47*	*1,050.56*
OVERALL AVERAGE			1046.12

2020 DOMESTIC AND INTERNATIONAL PASSENGERS BY GATE TYPE
DESIGN LEVEL OF SERVICE "F"

	2020		YR PX FLOW RATES (x1000)		ANNUAL PASSENGERS	
DOMESTIC AND INTERNATIONAL GATES	**GATES**				**2020**	**2020**
	NOMINAL	NBEG	NOMINAL	NBEG	NOMINAL	NBEG
Commuter group I	5	2	162.003	190.097	810,015	380,194
Commuter group II	15	11	222.223	227.750	3,333,345	2,505,250
Commuter group III	5	5	295.310	301.740	1,476,550	1,508,700
Narrowbody group III	31	31	381.832	381.832	11,836,792	11,836,792
Group IIIa (B 757 equivalent)	21	23	397.993	420.035	8,357,853	9,660,805
Widebody group IV	40	60	444.509	469.737	17,780,360	28,184,220
Group V (A 340, B 747equivalent)	50	85	475.478	512.840	23,773,900	43,591,400
Group VI, Future Large Acft	5	12	538.425	555.528	2,692,125	6,666,336
	172	229			70,060,940	104,333,697

		SUB TOTAL ANNUAL P›	104,333,697
2020 THEORETICAL REMOTE PARKING PASSENGER CAPACITY:	4,088,000		
2020 EFFECTIVE REMOTE PARKING PX FLOW CAPACITY:		SUB TOTAL ANNUAL P›	3,115,137.76
2020 TOTAL GATE CAPACITY IN TERMS OF ANNUAL PASSENGERS:		**TOTAL ANNUAL PX**	**107,448,835**

AVIATION GROUND ACCESS

The adopted regional aviation scenario will create ground access impacts at existing and proposed regional commercial airports, most notably, Ontario and El Toro, where forecast demand growth is greatest. Although the scenario does not include infrastructure expansion at LAX, aviation activity is expected to increase to the airport's physical capacity limit, placing additional strain on local roads and freeways. The RTP provides a framework in which critical ground access infrastructure improvements can be planned and implemented. A number of freeway, arterial, rail and transit improvements are proposed in the RTP that address passenger and cargo ground access issues as part of the overall transportation investment strategy in the region. The success of the decentralized airport system delineated in the regional aviation scenario is dependent upon the implementation of coordinated ground access improvement projects identified in the RTP. As airport demand produces additional development activities at and around local airports, the RTP will be updated to include carefully phased-in ground access improvements to support airport development.

Following are ground access-related baseline projects included in the RTP and drawn from the adopted 2000 Regional Transportation Improvement Program (RTIP):

BASELINE GROUND ACCESS PROJECTS			
AIRPORT	**PROJECT**	**TYPE**	**RTIP PUBLIC FUNDING (00$)**
BURBANK	I-5 (SR-134 to SR-170)	HOV	$25,426,000
	I-5 at Empire Ave	Interchange	$48,682,000
LAX	I-405 (I-105 to SR-90)	HOV	$30,135,000
	I-105 (WB Sepulveda to Nash)	Interchange	$10,202,000
	Sepulveda Blvd NB (at I-105 WB off-ramp)	Interchange	$2,340,000
	Sepulveda Blvd (Lincoln Blvd to Centinela Ave)	Arterial HOV	$2,662,000
	Arbor Vitae St (La Cienega Blvd to Airport Blvd)	Arterial	$1,401,000
	Arbor Vitae St (La Brea Ave to I-405)	Arterial	$2,000,000
	Aviation Blvd (Manhattan Beach Blvd to Arbor Vitae St)	Arterial	$13,984,000
	Arbor Vitae St (Inglewood Ave to Oak St)	Intersection Improvements	$4,418,000
LONG BEACH	SR-19 Lakewood Blvd	Arterial	$15,890,000
PALMDALE	SR-14 (Pearblossom to Ave P-8)	HOV	$29,072,000
	Ave L at SR-14	Overcrossing	$4,900,000
	20th St E (Ave P-8 to Elizabeth Lake Rd)	Arterial	$5,000,000
	Ave L (20th St E to 30th St E)	Arterial	$690,000
	Ave O (10th St W to Sierra Hwy)	Arterial	$3,500,000
	Sierra Hwy (Ave M to Ave J-2)	Arterial	$5,158,000
		LOS ANGELES COUNTY TOTAL	**$205,460,000**

BASELINE GROUND ACCESS PROJECTS (cont.)			
AIRPORT	**PROJECT**	**TYPE**	**RTIP PUBLIC FUNDING (00$)**
EL TORO	ETC/SR-261 (SR-91 to I-5/Jamboree Rd)	Mixed Flow (Toll)	
	Alton Pkwy (Irvine Blvd to FTC)	Arterial	$22,221,000
JOHN WAYNE	I-405 SB (MacArthur Blvd to Culver Dr)	Auxiliary Lane	$12,903,000
	SR-55 (I-405 to Dyer Rd)	Auxiliary Lane	2557000
	SR-73 (Birch St to I-405)	Mixed Flow (NB) & HOV	$17,488,000
	SR-73/SJHC	Mixed Flow (Toll)	
	SR-55 to I-405 south, HOV direct transitway	HOV Transitway	$16,462,000
	Von Karman at I-405	Overcrossing	$6,951,000
	MacArthur Blvd & Jamboree Rd	Intersection	$1,698,000
		ORANGE COUNTY TOTAL	**$80,280,000**
MARCH	Oleander Ave (Patterson Ave to Indian St)	Arterial	$7,348,000
PALM SPRINGS	I-10 at Palm Drive/Gene Autry Trail	Interchange	$11,000,000
	Gene Autry Trail (Vista Chino to Salvia Rd)	Arterial	$38,022,000
	Ramon Rd (Sunrise Way to El Cielo Rd)	Arterial	$1,871,000
		RIVERSIDE COUNTY TOTAL	**$58,241,000**
ONTARIO	SR-60 at Grove Ave	Interchange	$500,000
	Grove Ave at Holt Ave	Intersection	$900,000
	Grove Ave (Belmont St to Airport Dr)	Arterial	$10,290,000
	Grove Ave (State St to n/o Holt Ave)	Arterial	$1,976,000
	Mission Blvd (Benson Ave to Milliken Ave)	Arterial	$9,600,000
SAN BERNARDINO	I-10 at Tippecanoe	Interchange	$7,200,000
	I-215 (Orange Show Rd to 2nd St)	Interchanges	$23,500,000
	Del Rosa Dr (6th St to Baseline St)	Arterial	$450,000
	Rialto Ave e/o Waterman Ave	Bridge	$300,000
SO. CAL. LOGISTICS	I-15 NB (Mojave Dr to SR-58)	Mixed Flow	$68,625,000
	I-15 SB (Mojave Dr to SR-58)	Mixed Flow	$79,771,000
	Adelanto Rd (Crippen Ave to Colusa Rd)	Arterial (paving)	$750,000
	Air Base Rd (US-395 east to Adelanto city limits)	Arterial	$300,000
	El Evado Rd (Palmdale Rd to Air Base Rd)	Arterial	$4,000,000
	National Trails Hwy (I-15 to Air Base Rd)	Arterial	$1,200,000
		SAN BERNARDINO COUNTY TOTAL	**$209,362,000**
		GRAND TOTAL	**$553,343,000**

Following are ground access-related plan projects included in the RTP:

PLAN GROUND ACCESS PROJECTS			
AIRPORT	**PROJECT**	**TYPE**	**PUBLIC COST (97$)**
BURBANK	I-5 (at Buena Vista St)	Interchange	$12,000,000
	San Fernando Rd	Rapid Bus	$102,000,000
LAX	SR-1 Lincoln Blvd (LAX to I-10)	Arterial	$46,000,000
	SR-1 Sepulveda Blvd (Howard Hughes Pkwy to Century Blvd)	Arterial	$10,000,000
	I-405 Airport Connector Rd (Howard Hughes Pkwy to Arbor Vitae St)	Arterial	$4,000,000
	Arbor Vitae Ave (La Brea Blvd to Airport Blvd)	Arterial	$7,000,000
	Culver Blvd (SR-90 to I-405)	Arterial	$6,800,000
	Imperial Hwy (Sepulveda Blvd to I-5)	Arterial	$2,000,000
	Green Line Extension to LAX	Light Rail	$0
	Century Blvd	Rapid Bus	$47,000,000
	Florence Ave	Rapid Bus	$131,000,000
	Roscoe Blvd	Rapid Bus	$106,000,000
LONG BEACH	Lakewood Blvd (Spring St to Conant St)	Arterial	$11,000,000
	Iron Triangle Intersection (PCH, Lakewood Blvd, Bellflower Blvd)	Intersection	$37,000,000
	Long Beach Traffic Circle (PCH, Lakewood Blvd)	Intersection	$22,000,000
PALMDALE	SR-14 (Ave P-8 to Ave L)	HOV	$23,000,000
	10th St W (SR-14 to Ave M)	Arterial	TBD
	20th St E (Ave G to Ave L)	Arterial	$7,000,000
	Ave L (60th St W to SR-14)	Arterial	$6,000,000
	Ave L (SR-14 to 50th St E)	Arterial	$8,000,000
	Ave M (SR-14 to 10th St E)	Arterial	$3,000,000
	Ave P/Rancho Vista Blvd (Ave N to 50th St E)	Arterial	$42,000,000
	Ave P-8/138 (SR-14 to 120th St E)	Arterial	$70,000,000
	Avenue O (Sierra Hwy to Rancho Vista Blvd)	Arterial	$34,000,000
	Palmdale Blvd (SR-14 to 10th St W)	Arterial	$3,000,000
	Sierra Hwy (Ave P to Ave M)	Arterial	$23,000,000
	Sierra Hwy (Pearblossom Hwy to Ave P)	Arterial	$22,000,000
		LOS ANGELES COUNTY TOTAL	**$784,800,000**

PLAN GROUND ACCESS PROJECTS (cont.)			
AIRPORT	**PROJECT**	**TYPE**	**PUBLIC COST (97$)**
EL TORO	I-405 NB @ Culver and Sand Canyon	Auxiliary Lanes	$12,000,000
	I-5/I-405 NB Alicia Pkwy to Sand Canyon	Auxiliary Lanes	$2,000,000
	SR-133 (at Sand Canyon)	Interchange	
	Irvine/Trabuco (El Toro to I-5)	Smart Street	$18,000,000
	Alton Pkwy (SR-241 to I-5)	Arterial	$36,000,000
	Irvine Blvd (Sand Canyon to Alton)	Arterial	$32,000,000
	Sand Canyon Av (I-5 to Irvine Blvd)	Arterial	$36,000,000
	Trabuco Rd (I-5 to e/o Sand Canyon)	Arterial	$32,500,000
	Additional O&M, 2015-2025	O&M	$7,000,000
	Intermodal Transportation Center	Intermodal Center	$50,000,000
	Shuttle Service (Airport to Irvine Metrolink)	Shuttle Service	
JOHN WAYNE	SR-55 (I-5 to MacArthur Blvd)	Auxiliary Lanes	$40,000,000
	Bristol St	Rapid Bus	$110,000,000
	Main St	Rapid Bus	$110,000,000
		ORANGE COUNTY TOTAL	**$485,500,000**
MARCH	I-215 (Ramona Exwy to E Jct SR-60/I-215)	HOV	$41,000,000
	Alessandro Blvd (Arlington Ave to Day St)	Arterial	$38,000,000
	Alessandro Blvd (Day St to Lasselle St)	Arterial	$2,000,000
	Alessandro Blvd (Lasselle St to Gilman Springs Rd)	Arterial	$44,000,000
	Perris Blvd (Reche Vista Dr to Iris Ave)	Arterial	$24,000,000
	Perris Blvd (Iris Ave to Ellis Ave)	Arterial	$59,000,000
	Van Buren Blvd (Trautwein Rd to I-215)	Arterial	$24,000,000
	San Jacinto Line (Perris to Hemet)	Commuter Rail	$63,000,000
PALM SPRINGS	Mid Valley Pkwy - Gene Autry Way (Ramon Rd to Mesquite Ave)	Arterial	$500,000
	Ramon Rd (Palm Cyn to Sunrise Wy)	Arterial	$3,000,000
	Ramon Rd (Gene Autry Trail to E Bank of Whitewater River)	Arterial	$11,000,000
	Ramon Rd (Landau Blvd to Date Palm Drive)	Arterial	$2,000,000
	Ramon Rd (Date Palm to Da Vall)	Arterial	$2,000,000
	Ramon Rd (Bob Hope Dr to I-10 (includes bridge))	Arterial	TBD
	Ramon Rd (I-10 to Monterey Ave)	Arterial	TBD
	SR-111 (at Gene Autry Trail)	Interchange	$5,000,000
		RIVERSIDE COUNTY TOTAL	**$318,500,000**
ONTARIO	I-15 (Riverside Co. Line to I-215)	HOV	$81,000,000
	I-10/I-15 HOV Connectors (S to/from W & N to/from W)	HOV Connector	$24,000,000
	SR-60 Los Angeles County Line to I-15	Truck Lanes	$550,000,000
	I-15 from Riverside County Line to US-395	Truck Lanes	$622,000,000

PLAN GROUND ACCESS PROJECTS (cont.)			
AIRPORT	**PROJECT**	**TYPE**	**PUBLIC COST (97$)**
ONTARIO (cont.)	4th St (Vineyard to Archibald)	Arterial	$2,000,000
	6th St (w/o Vineyard to Vineyard)	Arterial	$350,000
	Airport Dr (Grove to Vineyard)	Arterial	$3,000,000
	Airport Dr (Vineyard to Archibald)	Arterial	$2,000,000
	Airport Dr (Grove to Haven)	Arterial	$24,000,000
	Airport Dr (I-15 to Etiwanda)	Arterial	$5,000,000
	Archibald Av (I-10 to Airport Dr)	Arterial	$1,000,000
	Archibald Av (Philadelphia to s/o SR-60)	Arterial	$2,000,000
	Archibald Av (Riverside to Walnut)	Arterial	$500,000
	Euclid Av (SR-60 to Riverside)	Arterial	$1,000,000
	Grove Av (Mission to SR-60)	Arterial	$500,000
	Haven Av (SR-60 to I-10)	Arterial	$20,000,000
	Holt Bl (Benson to Vineyard)	Arterial	$6,000,000
	Inland Empire Bl (Archibald to Milliken)	Arterial	$4,000,000
	Inland Empire Bl (Milliken to Etiwanda)	Arterial	$4,000,000
	Inland Empire Bl (Vineyard to Archibald)	Arterial	$2,000,000
	Jurupa St (Turner to Haven)	Arterial	$2,000,000
	Vineyard Av (4th to Airport Dr)	Arterial	$5,000,000
	Haven Av at SR-60 and at I-10	Interchanges	$40,000,000
	Additional O&M, 2015-2025	O&M	$2,500,000
	Shuttle Service (Airport to Metrolink, parking)	Shuttle Service	
SAN BERNARDINO	I-10 (I-15 to SR-38)	HOV	$111,000,000
	SR-30 (Highland to I-10)	Mixed Flow	$34,000,000
	Mill St (Waterman Ave to Tippecanoe Ave)	Arterial	$1,000,000
SO. CAL. LOGISTICS	East-West High Desert Corridor (Falchion/Rancho)	Expressway	$90,000,000
	Air Base Rd (Koala Rd to George AFB)	Arterial	$1,000,000
	Air Base Rd (George AFB to National Trails Hwy)	Arterial	$3,000,000
	George Bvd (Air Base Rd to Phantom St)	Arterial	$2,000,000
	Mustang St (George Bvd to Phantom St)	Arterial	$1,000,000
	Nevada Av (George Bvd to El Evado St)	Arterial	$1,000,000
	Phantom St (Nevada Av to Air Base Rd)	Arterial	$2,000,000
	Sabre Bvd (George Bvd to Phantom St)	Arterial	$1,000,000
	Starfighter Bvd (George Bvd to Phantom St)	Arterial	$1,000,000
		SAN BERNARDINO COUNTY TOTAL	**$1,651,850,000**
REGIONWIDE	Maglev		
		GRAND TOTAL	**$3,240,650,000**